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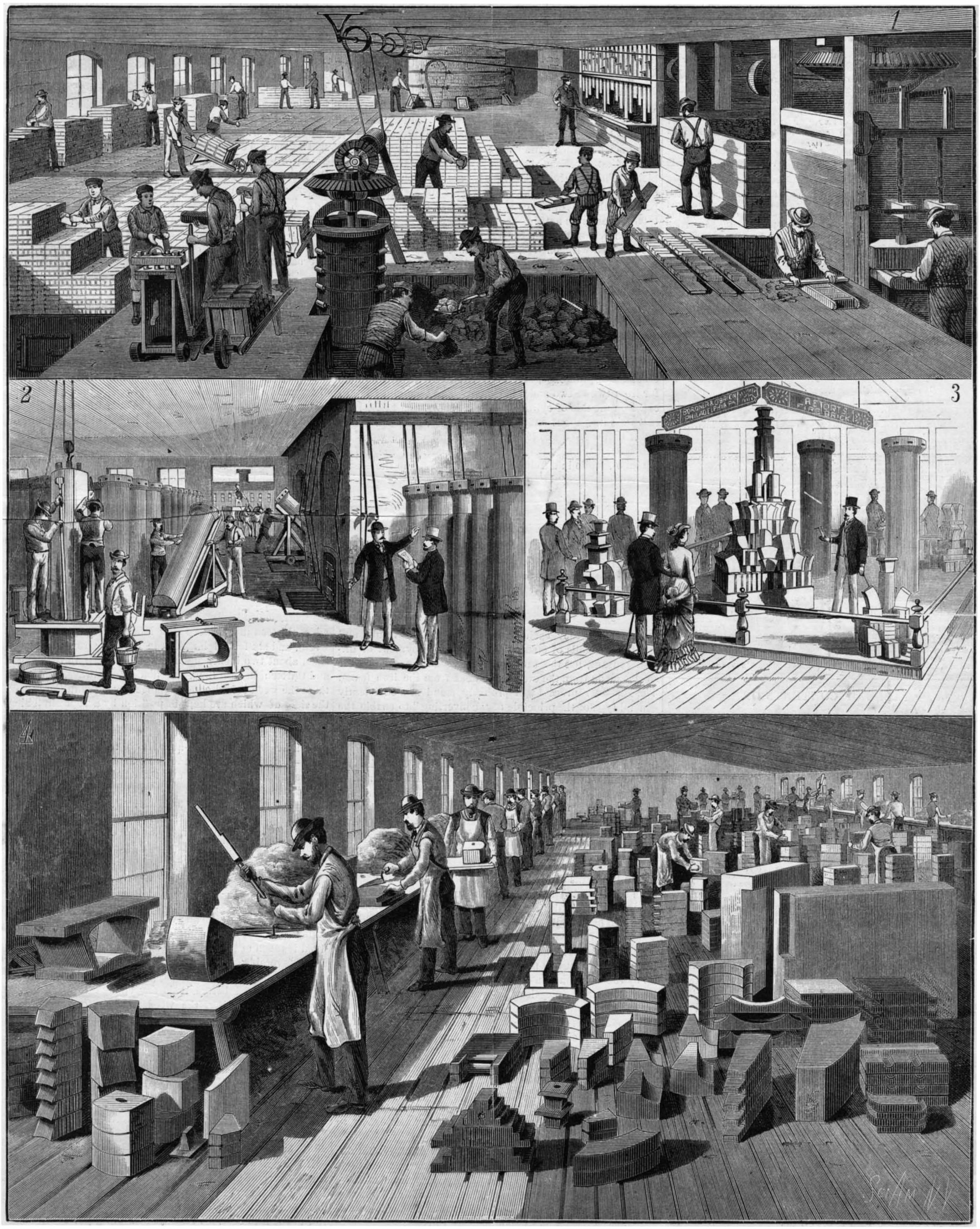

THE MANUFACTURE OF FIRE BRICK, TILE, AND CLAY RETORTS.—WORKS OF BORGNER & O'BRIEN, PHILADELPHIA.—[See page 36.]

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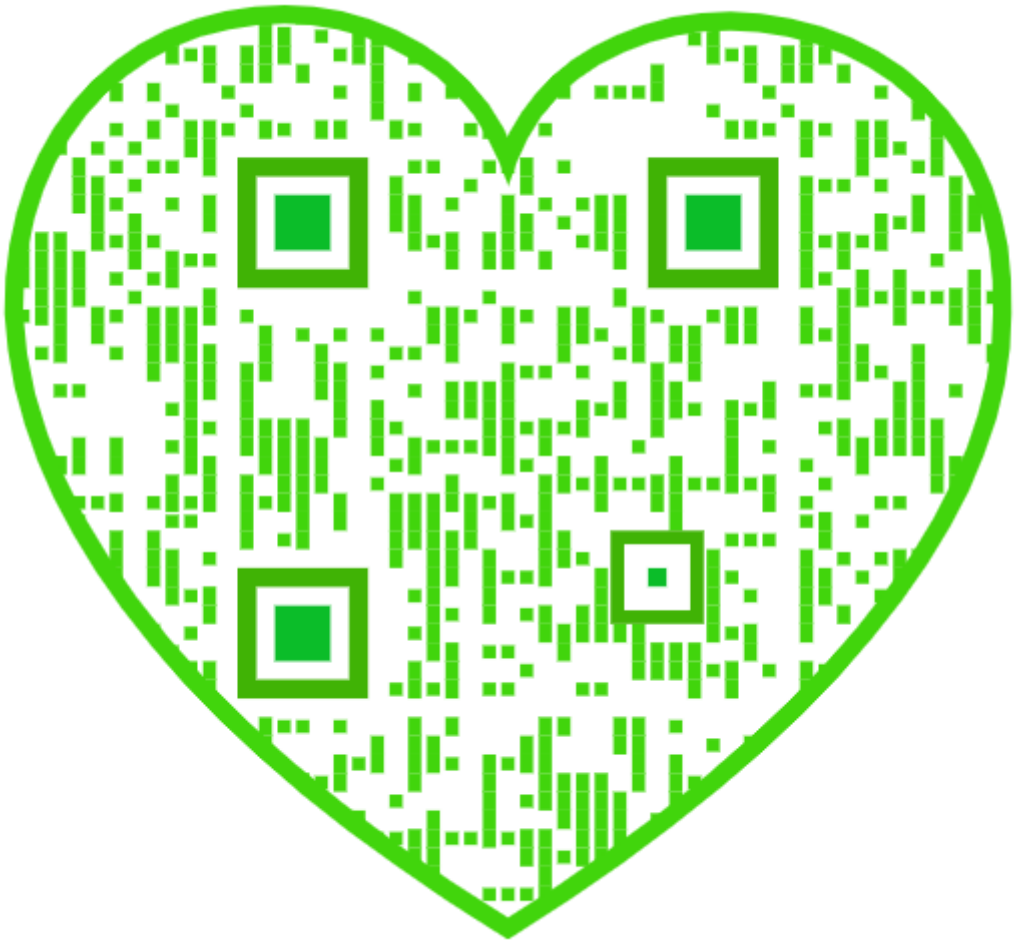

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Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions	42	Iron for lead in shot	32
Air current a mine lead	41	Japanese seaweed	32
American paper pulley*	38	Marsden, Mr., on the parallax	36
American industries, No. 86*	36	Mechanical inventions	42
Antiseptic pow. ammonia vapors	33	Moderate steam expansion	35
Artillery, English and Egyptian	33	Moulding cutters, draught of*	40
Automatic gate*	41	Natural history notes	41
Balanced steam valve*	40	Oyston's hose nozzle*	35
Bett's guard for fireplaces*	35	Paper from bark	35
Borgner & O'Brien works, Pa.*	31	Peppermint, manufacture of	39
Brass nozzle, novel*	35	Perkins' Jacob, ice mach., 1834*	34
Bull direct process, the	38	Power vs. hand drilling	37
Centering rest for lathes*	40	Preservation of butter	35
Chemistry of elec. accumulator	38	Recipes, useful	37
Chemistry of hay and ensilage	36	Reclining chair*	40
Color, to restore	39	Sad iron holder*	41
Consumption, sulphuric acid in	33	Safe safety lamp, a	38
Corn planter, improved*	40	Shaft loop, new*	40
Cox & Son's vertical engine	38	Shavings fed to furnaces*	34
Denver Exhibition, the next	35	Steam valve, balanced*	40
Dimples, how made	37	Steel and cast steel	32
Electric light in trains	35	Strontia beds, Sicily	38
Engineering inventions	42	Sulph. acid in consumption	33
Farm machinery, care of	34	Surgical operation for filaria	34
Fence posts	37	Temperature on magnetization	33
Finical finish	32	Testing potash and soda	33
Fire brick, etc., manuf. of*	31	Toy railway*	40
Fire escape, new*	41	Transfer process on glass	41
Glass blowing machine*	39	Underground steam pipes	37
Gold bar, a large	38	Uric acid, synthesis of	36
Grubbing shears, improved*	40	Vanderbilt on fast locomotives	35
Guard for fireplaces*	35	Vertical engine, improved*	38
Henoque's transfer process	41	Wagon box stake*	41
How fire sweeps wooden houses	37	Watch regulator, improved*	40
Ice machine, the first*	34	Weighing scales, balance*	40
Ice storage, family use	33	Wright & Mackie's glass blow.*	39

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 368,

For the Week ending January 20, 1883.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—Improved Sixteen Horse Compound Steam Plowing Engine.—1 figure 5863
Improved Tank Locomotive.—1 figure 5863
Efficiencies of Gas and Steam Motors. By THOMAS HOLGATE 5864
The Training for Students in Civil Engineering. By GEORGE L. VOSE.—How civil engineering in this country differs from that in Europe.—Recent development of the science of civi engineering.—Schools for the training of engineers.—Requirements of American civil engineers —Meeting new problems.—Proper training for American engineers.—Mathematics in engineering.—Inapplicability of higher mathematics to practical problems.—The one essential requisite of an engineer.—Proportionate judgment in engineering.—How to teach engineering —What to teach in engineering schools.—The proper aim of engineers.—Business aspects of engineering. 5865
On the Balancing of Machinery.—Deduced from experiments at the Defiance Machine Works, Defiance, Ohio.—14figures.—Introductory.—Cause of jarring in unbalanced rotating bodies —System of balancing.—Another plan —Proportional scale and its manipulation —Balancing car wheels.—Maxims deduced from experiments. 5867
Tourin's Machine for Preparing Saddle Leather —2 figures.—The treading cast for stuffing leather.—Machine for chawing leather 5870

II. TECHNOLOGY AND CHEMISTRY.—Creosote.—Its Tests and Action. By M. HAGER.—Therapeutic effects of beechwood tar creosote.—Influence in catarrh.—Consumption.—Asthma.—Varieties of creosotes and phenols.—Characteristics and tests 5876
Report upon Creosote. By Prof. P. W. BEDFORD 5876
The Adulteration of Olive Oil. By CH. MARIE 5876

III. HYGIENE MEDICINE, AND SURGERY.—The Recent Congress of German Surgeons.—Noteworthy facts and suggestions.—Naphthalin. Peat as an antiseptic.—Corrosive sublimate —Iodoform.—Muscle grafting.—Partial resection of the temporal bone.—After-treatment of extirpation of the larynx.—Operations on the thoracic viscera.—Resections of the lungs.—Œsophagoscope and gastroscope.—Resections of the pylorus.—Removal of the spleen.—Laparatomy above Poupart's ligament.—Suture of the bladder 5877
Obscure Cases of Inebriety. By T. D. CROTHERS, M.D 5877

IV. ELECTRICITY. HEAT, ETC.—The "Ferranti" Alternating Current Machine.—8 figures 5874
On the Transformation of Static Electricity into Voltaic Currents 5875
Heat.—Error in popular view of heat radiation 5875

V. ART AND ARCHITECTURE.—The Royal Courts of Justice.—New Law Courts, City of Westminster, London.—4 figures.—The principal entrance from the Strand —Full page view of the Strand front —The Carey Street front.—Plan of the courts around the central hall 5870

VI. MISCELLANEOUS.—Prevention of Mould 5878
Churning with the Wind.—1 figure.—Windmill churn 5878
Corn 5878

STEEL AND CAST STEEL.

The growing importance and increasing employment of steel in machinery and ship building, and the frequent use of the term in speaking or writing of mechanical industries, have tended to confuse the popular ideas as to what steel is, and what steel was. The word itself conjures up ideas of cutting implements mainly, of a metal capable of being so hardened and tempered as to cut other metals, rocks, and almost all mineral substances as well as to work wood and a hundred other soft materials. And when steel is spoken of as being used for shafting, for heavy castings, for plates of which to build up the sides of ships, for railroad rails, and similar purposes, the ordinary and unmechanical mind is confused, and doubts the economy and the advantage of using the material for such purposes. Perhaps a brief description of processes may serve to make distinction.

For the production of cast steel the best Swedish iron is used, that known to the trade as "Danemora iron" being generally employed, although iron possessing similar properties but from other localities is largely used. Bars about three inches wide by five-eighths of an inch thick are of a handy and much used size. These are packed in air tight chambers with fine charcoal, and so arranged that no two bars touch, and fires are kept up from nine to fourteen days by means of furnaces of anthracite coal. Bituminous coal also has been and is used with satisfactory results. Test bars may be drawn from time to time, until by the judgment of an experienced workman the cementation is complete. This roasting of the iron in combination with charcoal imparts to the iron a certain degree of carbon as compared with the other constituents, that has the effect to totally change its nature.

When removed from the cementation furnace the bars are covered with blisters, hence the name "blister steel" for steel in this condition. Formerly—within forty years—this blister steel was largely used by blacksmiths for purposes for which now only cast steel is employed. In the "relaying" of axes, for instance, it was used, the quality of the steel being greatly improved by repeated hammerings after heatings.

The bars of blistered steel are very brittle, and are broken up into pieces of about one pound weight or less, put into crucibles of plumbago, and subjected to an enormous heat for from two to two and a half hours, and then poured into cast iron moulds of cylindrical form inside, the ingot thus cast weighing about fifty pounds usually, although much larger ingots are made if the after nature of the work requires it, or the resultant product demands. If the top of the ingot, while in a fluid state, does not sink in the center (the moulds being placed on end while the steel is poured), it is evidence that the casting is unsound, and no after reheating and hammering can rectify the fault, the only remedy being to break up and remelt the honeycombed steel.

The ingots are reheated after being cast, and subjected to the hammer and then to the rolls. And in the form of flat and round bars, and rods, and plates, this product goes out to the world as cast steel, the great cutting material.

For the production of the steel used for building and common mechanical purposes and for railroads there are several processes, but they each bring about a similar result, and except for details of manipulation and employment of differing means, use the same materials. In some cases the steel is made from the ore, but in most from the iron (cast). The Bessemer process will probably stand as a sufficiently general type of the principle of "converting" to enable the reader to understand the difference between "steel and cast steel." In the conversion of iron into common, or Bessemer steel, the iron used is pig, or cast iron, and not wrought iron in bars. This iron is selected for the quality of its ore, and so mixed as to aid in the process of conversion and to produce satisfactory results. These particulars are unnecessary for the purposes of this article.

The iron is melted in a cupola just as it is in any iron foundry, and when melted is run into an immense pear-shaped or pitcher-shaped vessel suspended on hollow trunnions, through which a powerful blast of compressed air is driven by means of blowing cylinders at a pressure varying from fifteen to twenty-five pounds per square inch. This pressure is varied during the process, which for seven tons of melted iron would require fifteen or eighteen minutes. This blast of air rushes through the boiling metal, burning out the phosphorus and sulphur, and a portion of the carbon, usually about 10 per cent. This loss of carbon is made up by the addition of a certain amount of *spiegeleisen* to the ingredients. "Spiegeleisen"—"mirror iron"—is an iron containing an unusual amount of carbon.

The converters are made of thick boiler iron, and lined with a cement of ground flint and quartz, fire clay not being sufficient to withstand the intense heat generated by the union of the oxygen of the blast with the sulphur, phosphorus, and carbon of the metal. The end of the converting process is determined by the color of the flame rushing from the top of the converter. At first, when the blast is first put on, it is blue and smoky, afterward red, then graduating to yellow, and at last to pure white.

When the process is completed the blast of air is shut off, the immense pitcher is turned on its trunnions, its contents poured into large ladles, which empty into iron moulds, casting huge ingots, sometimes of a weight of 3,000 pounds. The after working of this Bessemer steel is similar to that of cast steel, a reduction by hammer and rolls.

It will be seen from these general descriptions that the production of "decarbonized," "crude," "low," or "Bessemer" steel and that of cast steel are different in materials used, methods employed, and in results reached.

FINICAL FINISH.

If mechanics generally realized how much labor is lost in the mere ornamentation of useful tools, they would discourage it in their own practice, and in their patronage of the manufacturers. There is a grateful sense of beauty in a well finished tool, but to the mechanical eye this finish is more in good proportion and adaptability to use than in meretricious ornamentation.

There is much time wasted in the shop by foolish experimenting to ascertain how much of fantastic "giggering" can be crowded in a small space on a bench implement. A simple scratch awl, that should be at best but a rod of quarter inch octagon Stubs' steel, tempered and sharpened, is sometimes so crowded with filed facets and clamp turned beadings as to become a most unhandy tool.

Sometimes more glaring substitutions of finical finish for useful form are noticed. The employment of the knurled-headed screw, or the knurled nut, for a thumb screw, or "butterfly" head screw and nut, is very common. The knurled head or nut can be formed in the lathe and presents an elegant appearance, and it may readily be turned off a bar or rod without the previous work of forging. But when done, its entire leverage depends upon the squeezing power of the thumb and fore finger, the corrugated edge of the nut or head bedded in the tender flesh of the balls of the finger and thumb. The butterfly thumb nut must be forged, but this is no objection when these nuts and screws may be bought by the gross, drop-forged, and in just the condition for final finish. These nuts and heads are elegant and easy to handle, and, mechanically considered, are quite as ornamental as the knurled nuts.

Japanese Seaweed.

Consul Quin, writing on the trade of Japan, mentions that a considerable increase has lately taken place in the exports of seaweed, and gives in his last report the following description of the method in which cut seaweed is prepared for the market. For making the finest cut seaweed, the best long seaweed is used, the newer the better, on account of the color. After the bundles are opened, they are picked, and as much sand as possible shaken out; the selected weed is then placed in large boilers, and is boiled for an hour or more, until the proper color is obtained, which should be quite uniform and of a good clear green. After boiling, the seaweed is hung up on poles in the air to partially dry it, after which it is again carefully sorted, and all ragged pieces and those of a pale whitish color are rejected; the selected weed is then handed over to a number of women, who open it out and roll it into flat coils of about ten pounds each. As soon as these coils have remained long enough to flatten the seaweed, they are uncoiled, and the pieces of weed are laid out one on the top of the other on a board a little over four feet long, to the depth of eight to ten inches; they are then cut into four lengths of thirteen inches each, and these pieces are tied into bundles ready for the workmen to lay in the presses, which are about six feet wide, thirteen inches deep (the length of the pieces of seaweed), and six feet high. At the bottom a row of wooden slats, about two inches and a half broad, half an inch thick and thirteen inches long, are placed edgeways, and upon these the weed is laid carefully piece by piece in the frame, the sides of which are kept in position by a rope stretching across the top; a movable plank at the back, which is raised as the workman proceeds, keeps the weed thoroughly even. When the frame is full—about two tons going into one press—a similar lot of slats to those at the bottom are placed on the top of the seaweed, and the whole is pressed as tight as possible, by means of a rough capstan, to get rid of all unnecessary moisture, and to render the mass firm enough for cutting. The frame is then laid down flat; and one of the side planks being removed, the compressed weed is planed with an ordinary carpenter's plane, set so as to cut it to the required thickness—about one-twentieth of an inch—along the edges and with the grain. The object of the slats is to enable the workman to plane to the edges, and they are removed one by one as he progresses with his work. Each man can plane, on an average, one hundred and seventy pounds of seaweed per day. After planing, the cut seaweed is taken out of doors and shaken out to dry on mats; under favorable circumstances, one day is sufficient for this operation, but it frequently happens that as many as three days are required before it is dry enough to pack away. After the final drying, the weed is ready for the market, and is packed away in boxes containing about sixty-six pounds each. The rejected ends of the first class seaweed are used up, together with ordinary long seaweed of an inferior quality, to make cut seaweed of a lower class. While undergoing the various processes, the material loses 20 per cent in weight, and that fact, joined to the price of the labor expended in its manufacture, brings the cost to more than double the average of long seaweed.

Iron as a Substitute for Lead in Shot.

It is reported that a company has been formed in Iowa for the purpose of manufacturing sporting shot from iron. It is stated that the trials which have been made of the shot have proved it to be fully equal, and in some respects superior to the lead shot. Ovens are now being put up to anneal the shot.

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Ice Storage for Family Use.

Wrap a block of ice in a blanket and hang it where there is but little, if any, movement of the air. The ice will melt very slowly; in part because the blanket is a poor conductor of heat, but chiefly because the water produced by the melting of the ice is largely or wholly evaporated from the outer folds of the blanket, and in vaporizing absorbs so much of the heat received from the surrounding air that the temperature of the ice is kept low. The inner folds of the blanket will be frozen to the ice; the ice will remain dry; and will seem to evaporate rather than melt. The same ice, if exposed to the air, or if covered with water, or if allowed to stand where the water from its melting does not freely drain away, will waste rapidly.

A good ice house is one that does for a large quantity of ice as nearly as possible what the flannel blanket does for the single block. It must cut off the heat of the adjacent air and ground; it must secure the instant withdrawal from the ice of all water; and it must utilize as far as practicable the cooling effect of evaporation. The ice will inevitably waste more or less; the great object is to delay the melting.

Another point is important. The wastage of a large body of ice is relatively much less rapid than that of a small body, other conditions being equal. For example, a cube of ice one foot on a side presents six square feet of surface for melting. A cube ten feet on a side contains a thousand times as much ice, but its melting surface is only a hundred times greater, or six hundred square feet. Its relative exposure to melting is therefore only one-tenth as great as that of the smaller cube. If ice is stored at all, it is economy to store liberally.

Fortunately the materials necessary for the construction of an ice house, used simply for storage, are of the simplest and cheapest character; and the actual cost of cutting and housing the ice is usually so low that there is no great need of erring on the side of too small a store.

Disappointment in the matter of ice keeping is usually traceable to an obvious neglect of one or more of the essential conditions illustrated by the blanket. The ice is not sufficiently protected by impervious walls against the inflow of heat from the outer air and the ground, though the utmost care may have been taken to shield the house from direct sunshine. Or the drip from the slowly (or rapidly) melting ice is not promptly got away from the ice; or the drainage channel allows air to enter the house and circulate between or around the blocks of ice. Sometimes proper care is not taken to avoid the frequent flow of warm air into the ice chamber when the doors are opened for the taking out of ice, or the space next under the roof is not properly ventilated to prevent its becoming heated by sunshine and to utilize whatever chilling effect may be secured through the speedy evaporation of any moisture that may gather over the ice.

The situation and construction most suitable for an ice-house for family use have been well described in a recent issue of the *Century* magazine. The writer says:

The best site for a family ice house is some shady place under a tree, or the north side of a building which is also protected from the wind. Shade is of the first importance, and shelter from the wind next: so if there is a choice, take the shady place. If a good position cannot be found, put it anywhere. The melting ice in the house causes a constant flow of water. If the soil on which the house is to stand is sandy or gravelly, and has a gentle slope, there is nothing to do but to dig a cellar about two feet deep and fill it with stones. Cover the upper layers with smaller stones and sand. This will make the floor on which the ice is to rest. The water will escape easily through the sand and stones, and there will be no chance for currents of air to flow upward into the house. The tendency of the air in a badly made ice house is always to flow through it. Therefore, while there must be drainage, there must be no inlets for air. If the soil is wet and not easily drained, the surface must be covered two feet thick with stones, and the house placed on top of this. If this is done, the sides of the stonework must be made tight with mortar, to prevent the entrance of air. If provision must be made for carrying off the water, the pipe may be trapped to prevent the air from entering the pipe and thus getting into the house. A well-drained foundation having been prepared, a wooden sill must be laid, on which the walls are to rest. On this sill will rest the uprights. These may be simply planks eight inches wide and two inches thick. They may be placed at intervals on the sill, and held in place by a string piece on top. On the outside of the uprights may be nailed boards with battens of clapboards. On the inside they are simply boarded up with cheap stuff. The whole aim is to make a hollow wall. The space between the outside and inside boarding must be filled solid with tanbark, saw dust, or rough chaff of any kind. Upon the walls place a common pitch roof, boarded and battened or shingled. It must be rain tight, and must not be air tight. There should be an opening at the ends, or a hood or ventilator, to permit a free circulation of air through the upper part of the house. The door should have double walls filled with sawdust.

The ice should be cut with a saw into regular blocks, so that they will pack snugly. Of course, the thicker the ice the better; but carefully packed ice will keep if only three inches thick, provided it is properly packed in freezing weather, water being poured over each layer to fill the spaces with ice and exclude the air. The interior of the ice house should be cold before the ice is put in.

When the filling begins cover the entire floor with a layer of sawdust, tan bark, chaff, or cut straw, six inches or a foot deep. A space a foot wide should be left between the walls of the house and the pile of ice. Where the ice is to be piled lay down a floor of straight edged boards to cut off the air and keep the ice layers level. Cover this floor with a thick layer of sawdust, and as the ice is laid down fill in the space around the pile with sawdust and pack closely. This filling is to be added as the ice pile is built up. Over the top layer of ice put a liberal coating of sawdust or whatever material has been used for the heat excluding blanket.

A pile of ice ten feet square and ten feet high will contain about twenty-five tons; one twenty feet square and ten feet high will contain a hundred tons, allowance being made for unfilled spaces. Ice weighs 57·5 pounds to the cubic foot. Calling it fifty pounds to the cubic foot as piled, any one can roughly estimate the size of house required. It is well to allow a half for wastage.

Influence of Temperature on Magnetization.

M. Bersen has studied the influence of temperature on the magnetization of iron, steel, nickel, and cobalt. He places the bar to be experimented on in a constant magnetic field, at different temperatures, and compares its magnetic moments. To make this comparison he adopts the method of Gauss. His apparatus consists of a Bunsen battery of from six to ten cells, the current from which, after having passed through a commutator, traverses a retort carbon rheostat, then the coil which serves to produce the magnetic field. A galvanometer placed in a shunt enables this current to be kept constant. In this magnetizing coil is placed the bar, which causes a small declination needle, suspended by a thread to the interior of a copper cage, to deviate. The deviations are read by means of a mirror and scale. The magnetizing coil, which must be capable of withstanding high temperatures, is composed of a wire wound, without permitting the coils to touch, on a glass core, and covered with plaster. The whole is placed in a copper stove and heated by a gas lamp. The temperature, which is maintained constant as long as possible, is measured by a thermometer thrust into the stove. Some of the results obtained are as follows: As regards iron, magnetization is nearly independent of temperature. The total and temporary magnetizations increase up to 260 deg., then they decrease, while the permanent magnetization diminishes very slightly. With steel, the total magnetization increases at first, attains a maximum at 260 deg., and then decreases; the permanent magnetization attains its maximum toward 240 deg. Variations of temperature during the experiment exercise an influence on the magnetization, which increases under these conditions. If the temperature of a bar magnetized when cold be raised, its magnetization diminishes; the same occurs if a bar, which has been magnetized when hot, is cooled. If, now, we temper this latter, it retains a greater magnetic moment than if it had been worked at a low temperature. With nickel, the total magnetization slowly increases up to 240 deg., and after reaching 280 deg. decreases very rapidly, becoming *nil* at about 330 deg. Nickel magnetized at a low temperature and heated to 320 deg., loses all magnetization; if, on the other hand, it has been magnetized at 280 deg., and subsequently slowly cooled, its magnetic moment begins at first to increase, then decreases at about the ordinary temperature, but finally remains greater than at the temperature of magnetization. Cobalt behaves like steel.—*La Revue Industrielle.*

Separation of Magnesium in Testing for Potash and Soda.

BY G. CAMPARI.

The liquid from which the alkaline earths have been removed in the usual course of analysis contains only magnesium, potassium, and sodium, with ammonia salts that have been added in removing the other groups. These, being volatile, are removed by evaporation and fusion. The magnesium is then removed, and the potassium tested for by putting a small quantity of the residue in a porcelain dish, and pouring over it four or five c. c. of an alcoholic solution of hyposulphite of soda and bismuth.

If potassium is present, the salt turns yellow in a few seconds. The residue may also be dissolved in a little water, and a little of this solution added. A yellow precipitate of hyposulphite of potassium and bismuth forms either immediately or after some time, according to the quantity of potassium present.

The reagent mentioned is prepared as follows: basic nitrate of bismuth is dissolved in the least possible quantity of cold hydrochloric acid. Twice as much hyposulphite of soda is dissolved in the least quantity of water. Both solutions are made up to equal volumes by the addition of water, but kept separately. Just before using, two or three drops of each liquid are mixed and the mixture diluted with four or five c. c. of absolute alcohol. A clear, colorless solution is obtained, which shows the above described reaction (yellow precipitate) when mixed with any potassium salt.

After testing for potash, another portion of the residue is dissolved in water, and the sulphuric acid test made with chloride of barium. If sulphates are absent, a solution of carbonate of potash is added as long as a precipitate forms. The magnesia is precipitated as carbonate and filtered out, the filtrate slightly acidified with hydrochloric acid, and the excess of acid boiled out, or the solution evaporated to dryness. The new residue is tested for sodium with metantimoniate of potash.

If sulphates are present, enough barium salt is added to precipitate it, and then, without filtering, the carbonate of potash is added as before. If there is much magnesium present, the final residue will contain sodium in the presence of a large quantity of potassium, which renders the detection of sodium more difficult. In this case it is advisable to add hydrochloric acid to the filtrate from the carbonate of magnesia, and evaporate to a small volume. On cooling, a large portion of the chloride of potassium crystallizes out. The largest part of the potassium may be precipitated with tartaric acid before testing for sodium. The filtrate must be evaporated and the residue calcined, and then redissolved.—*Ann. di Chim.*

Antiseptic Power of Ammonia and Chloroform Vapors.

At a recent meeting of the Medical Society of London, Dr. Richardson read a paper on the properties of ammonia, chloroform, and ammoniated chloroform, as antiseptics (*Lancet*, Nov. 25, p. 892). He also exhibited two small specimens of lung, which had been preserved in chloroform vapor and had remained untouched in their respective bottles for thirty-five years, and were still well preserved. As an illustration of the antiseptic power of ammonia vapor, he showed a specimen of blood which had been drawn from a sheep's neck in April, 1862, and kept in a well-corked bottle ever since; it was still perfectly fresh and fluid. He found that structures containing much fat became saponified unless chloroform were mixed with the ammonia, and that when it was desirable to retain the color of the blood, the addition to the chloroform of coal gas which contained sufficient carbonic oxide for the purpose was entirely successful. The knowledge that it is possible to retain specimens of viscera in a perfectly sound state, during a long investigation, in ammonia or chloroform vapor, will be welcome to analysts and toxicologists. Dr. Richardson remarked that he feared the process could not be carried out on the large scale. He added that he had found that chloride of zinc and spirit embalmed a body perfectly, but made it too hard for dissection.

Sulphurous Acid in Consumption.

Most readers are aware that sulphurous acid is one of our most important bacillicides, and the more to be recommended as it can be inhaled with impunity. Mr. Julius Kircher, a pupil of Liebig, and owner of a chemical factory in Brooklyn, writes, says the *Medical and Surgical Reporter*, as follows to the *Zeitsch. f. d. Oestr. Apoth. Verein*:

The observation of Koch has found a brilliant confirmation in my factory, where a large quantity of sulphur is evaporated daily. That in this process a great deal of sulphurous acid is formed, can easily be imagined. During the forty-four years that my factory has existed none of the many laborers have ever been affected by tubercular consumption, nay, more frequently, enough persons in the beginning stages of this disease applied for admittance and were cured within a few weeks, simply by inhaling the sulphurous acid. If not too far progressed, these individuals become strong, stout, and perfectly healthy again.

All diseases zymotic in character, even cholera, stay away from his factory and those working there. Persons affected with bronchial catarrh are rapidly cured.

Phthisical patients should live in rooms where hourly 1 to 2 drachms of sulphur are evaporated on a warm stove. First eight or ten days there is increased irritation of cough and expectoration; then these cease, and the individual rapidly improves. Convalescents should live for a time in rooms filled with aromatic watery vapors.

English and Egyptian Artillery.

At a recent banquet of the Institution of Civil Engineers in honor of General Lord Wolseley, the latter in his speech said:

The Egyptian army was well-found in all the appliances of warfare that were essential to success. It had a fine artillery—indeed, the guns were the same as had been used by the Germans in the Franco-German war. The great superiority we had from first to last over the Egyptian artillery was this—that our guns when in action were enabled to overpower twice their number. The Egyptian gunners were excellent shots, but the reason we defeated them was that while the Egyptians used the old fashioned common shell which they had obtained from Messrs. Krupp, we adopted the shrapnel shell. The Egyptian shells sank deeply into the earth before they exploded. That alone furnished a lesson which we ought to take to heart—namely, that no nation could afford to fall behind other nations in the inventions of the day, and the nation which did, had nothing before it but disaster staring it the face. (Cheers.) He could not conceive a greater folly than that a government should stand still from motives of economy waiting until something better might be discovered and allow its army to be armed with an inferior rifle or an inferior gun, when they knew that other nations possessed superior weapons. He knew no greater treason that could be committed by a government.

It is stated that some kinds of woods, although of great durability in themselves, act upon each other to their mutual destruction. Experiments with cypress and walnut and cypress and cedar prove that they will rot each other when joined together, but on separation the decay will cease, and the timbers remain perfectly sound for a long period.

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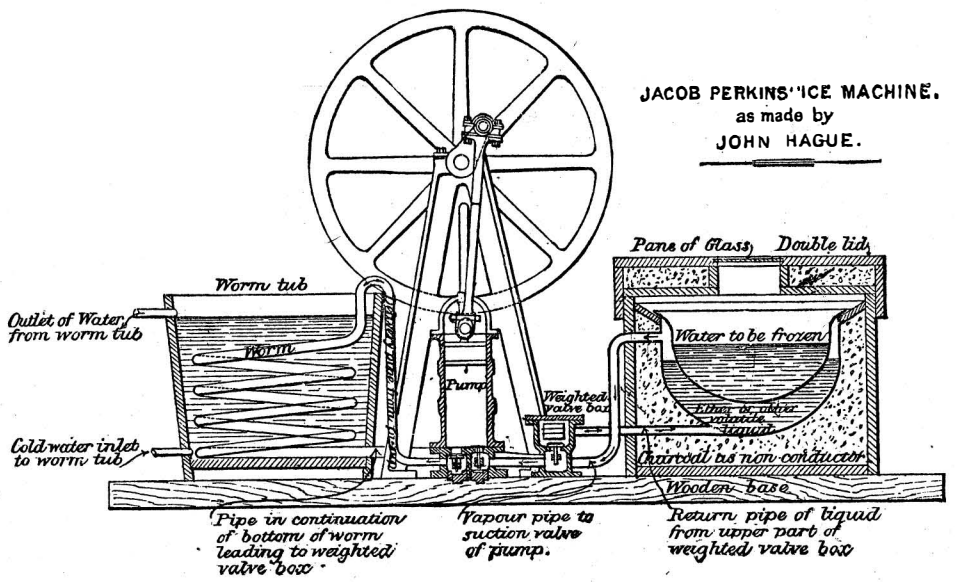
ONE OF THE FIRST ICE MACHINES.

It has occurred to me, says Mr. Frederick Bramwell, in the *Journal of the Society of Arts*, that it may interest those connected with ice making, if I were to recall to public attention the invention (patented in 1834, No. 6,662) of Mr. Jacob Perkins. A reference to this specification (if any one could get a copy of it, for it, like many others, is out of print) would show that Mr. Perkins claimed to have invented, not the freezing of water, or cooling of bodies by the evaporation of ether or other volatile liquid, but the essential thing for commercial purpose—the "apparatus or means, as above described, whereby I am enabled to use volatile fluids for the purpose of producing the cooling or freezing of fluids, and yet, at the same time, constantly condensing such volatile fluids, and bringing them again and again into operation without waste."

A small machine of this kind was made for Mr. Perkins by Mr. John Hague, the engineer, and Mr. T. R. Crampton (now, like Mr. Loftus Perkins, a member of your Council) and myself, who were apprentices at that time to Mr. Hague, assisted in its manufacture. It was intended to use sulphuric ether in the machine, but as a matter of fact, it was put to work with the volatile liquid arising from the destructive distillation of caoutchouc, and it succeeded in producing ice, and in doing so in the height of summer. The apparatus was a small one, carried on a wooden base—according to my recollection, some five feet long by two feet or two feet six inches wide. At one end there was a jacketed copper pan, the interior of which held the water to be frozen, while in the jacket was the volatile liquid and its vapor. The pan was inclosed in a wooden box, containing powdered charcoal as a non-conductor. From the top of the jacket a pipe was led away to the suction valve of an air pump, fixed in the middle of the wooden base. From the delivery valve of this pump a pipe proceeded to the top of a worm, contained in a worm tub, supported on the wooden base, at the end opposite to that where the jacketed pan was. The worm tub was supplied with water, from an inlet at the bottom, and the escape was by an overflow at the top. A pipe, in continuation of the lower end of the worm, was connected to the under side of a valve box, in which was a valve loaded to about fifteen pounds to the inch, so that the vapor in the worm was subjected to this pressure, as well as to the cooling influence of the water, and by these means was brought back to a liquid condition. From the upper side of the valve box a pipe proceeded to the bottom of the jacketed pan, to convey the liquid to it, thus completing the circuit.


JACOB PERKINS' ICE MACHINE.
as made by
JOHN HAGUE.
Worm tub
Outlet of Water from worm tub
Worm
Cold water inlet to worm tub
Pump
Weighted valve box
Pans of Glass
Double lid
Water to be frozen
Charcoal as non conductor
Wooden base
Pipe in continuation of bottom of worm leading to weighted valve box
Vapour pipe to suction valve of pump.
Return pipe of liquid from upper part of weighted valve box

JACOB PERKINS' ICE MACHINE, 1834.

I send a rough sketch of the apparatus above described, and I also send a tracing of the drawing of Perkins' specification, and a manuscript copy of the specification itself, in order that you may see how closely a practical working machine agreed with the drawing of the specification, the only difference, in truth, being that, had the machine been made exactly in accordance with the specification drawing, the block of ice must have been sawn asunder before it could have been removed.

NEW APPARATUS FOR FEEDING SHAVINGS TO FURNACES.

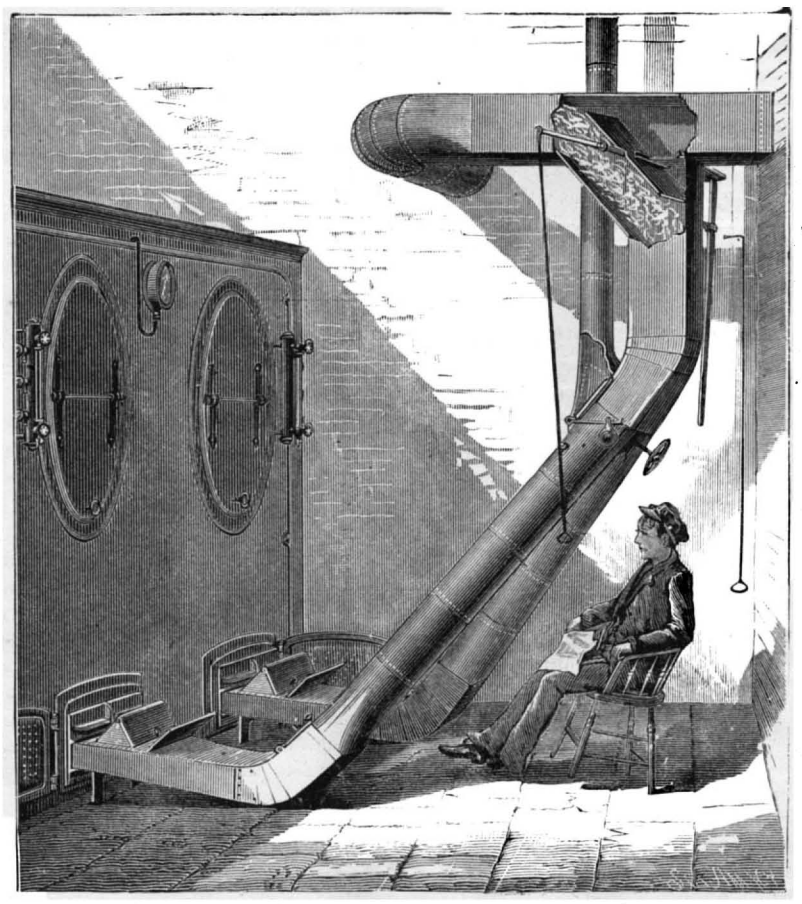
In many of the largest wood working establishments shavings are the only fuel employed in generating steam; therefore the proper introduction of fuel of this kind to the boiler furnace is a matter of great importance, as safety, economy, and uniform steam pressure and power all depend on careful and continuous firing.

To accomplish this by manual labor alone is difficult if not impossible; the necessity of frequently opening and closing the furnace doors, the irregularity of the heat, and the smokiness of the flues and chimney are all against this plan.

Our engraving shows a furnace feeding apparatus recently patented by Mr. L. P. Conklin, of 191 Java Street, Greenpoint, N. Y., which obviates all the difficulties common to hand firing, and is at the same time safe and automatic, requiring very little attention from the fireman. The shavings receiving room and the fan blower and conduits are the same as in the usual arrangements for conveying shavings from the machines to the shavings room. The discharge end of the shavings conduit is connected by a triangular chamber with a vertical pipe, having its lower end curved into a horizontal position, and forked to divide the stream of shavings between the furnaces. The extremities of the pipe are each provided with a nozzle wider and flatter than the pipe, which enters an oblong opening in a plate set up in front of the furnace. This plate may be removed whenever necessary. The nozzle is provided with a pivoted lid near the furnace, which may be opened at any time to introduce an extra supply of shavings if required. It is also provided with a slide working through the top of the nozzle, to regulate the shaving supply or to cut it off altogether. In the curved part of the main conduit are holes in the upper surface covered by a vertical pipe, containing a valve which is counterbalanced so as to raise easily to permit an escape of surplus air whenever the volume of air is in excess of that required to support combustion.

The triangular chamber at the junction of the additional pipe and the main feed pipe has a valve which may be adjusted so as to take more or less of the shavings from the main conduit leading to the shavings room. This valve is under the control of the fireman, and may be limited as to the quantity of shavings fed at any time, and the valve closes automatically whenever the blower stops, or when from any other cause the current of air ceases.

This device furnishes a continuous feed, with very little attention, and insures perfect combustion, and, in consequence, there is no smoke.



CONKLIN'S SHAVINGS FEEDER FOR BOILER FURNACES.

Volcanic Ashes and Lavas.

L. Ricciardi has collected a large number of analyses made by himself and others, and in a recent number of the *Gazzetta Chimica* he enters upon their discussion, and ends with the following conclusions:

1. The ashes are the product of the action of steam or aqueous vapor evolved from the semi-fluid mass.

2. The lava consists of crystals that have been formed within the volcano itself, and also of an amorphous mass which is often of a vitreous character.

3. The chloride of ammonia in volcanic products is formed by the direct union of nitrogen and hydrogen, as well as by the combustion of organic substances inclosed in the lava.

4. The sulphides in the ashes and lava are formed by the action of sulphureted hydrogen upon metallic oxides.

5. Phosphate of lime is a frequent constituent of lava, but only a small amount of it is present in the form of apatite. The remainder is one of the ingredients of the amorphous mass.

Surgical Operation for Filaria.

A surgical operation on the eye of a large dray horse which had been afflicted for some time with a worm in one of its eyes, was performed at the American Veterinary College, on the 9th inst., in the presence of some fifty students.

A reporter on one of our daily papers (New York *Sun*) thus describes the operation:

The hind legs of the horse were tied after he had been led to the middle of the room, the floor of which was covered with straw. His fore legs were similarly treated. The hind and fore legs were then drawn together, and the horse fell on his left side. A sponge with a little ether on it was put against his nostrils.

The Professor of Ophthalmology, assisted by D. Liautard and several other veterinary surgeons, stood near the horse's head. When, after a struggle of a few minutes, the horse became unconscious, the Professor produced a case of delicate steel instruments. The students held their breath. The Professor knelt near the head of the animal. With a keen-edged knife he made an incision in the opalescent cornea of the right eye, where the little white "snake" twisted and contorted. The parasite did not accept eth invitation to come out. The incision was enlarged by the use of a pair of curved scissors; but the snake preferred its native element to the untried world on which the door was opened to it.

Meantime a half dozen students were pressing the body of the horse with their hands and knees, in undulatory unison, to keep up respiration.

The Professor next resorted to a little instrument called Bowman's spoon. He stroked the cornea of the eye until the head of the parasite peered out. A pair of minute forceps closed upon its neck, and out came the snake, and a moment later was squirming in innumerable curves on a plate.

The students crowded around the plate. They saw a thin white worm about two and a half inches long, "of wire-like hardness, and," according to the Professor, "with a well-marked head." Dr. Liautard put it in a bottle.

Then a large force of students set to work to assist in restoring the horse by artificial respiration. They worked industriously for an hour. When the undulatory pressure on the body of the horse failed to arouse him, an intravenous injection of ammonia was tried. It did not work. The horse was then bled. He did not revive.

"He's dead," Dr. Liautard said. "Evidently there was something the matter with his heart. We will hold a post mortem."

The Care of Farm Machinery.

The advantage of keeping farm machinery from unnecessary exposure to the weather is cogently insisted upon by the *Ohio Farmer*, which says:

We have noticed that plows last, on an average, about three years; wagons, eight to ten years; reapers, five to eight; drills, eight to ten. We think these figures are fully as large as the truth warrants. We know of many implements that have not lasted so long, and of many which have lasted much longer. We to-day can point to wagons that have been in constant and hard use for twenty years, reapers that have stood the wear and tear of liberal use for more than fifteen years, drills that have been in use as long, and other agricultural implements that have stood the wear of fully twice the average age of such implements. These implements were not made of unusually good materials nor were they suffered to lie idle. They were put to constant use. What, then, is the secret of their greater endurance? It is simply this—they were taken care of. When not in use they were put away, and put away properly.

These implements not only lasted longer, but while they were in use they very rarely failed. They were always ready for work. The reapers did not break down in the middle of harvest and compel all hands to lie idle while some one went to the railway station to get repairs; the drills did not fail just when the wheat ought to be sown; the wagons were not always breaking down and occasioning delays and vexation. Another thing may be said in their favor, and that is that they always did good work. The reapers cut a smooth stubble and put the grain down in good condition; the plows did not refuse to scour; the drills put the wheat in just as a first class drill would; and these implements did good work not only while they were new, but till the last year they were in use.

A CORRESPONDENT says that the St. Louis Union Depot Elevator Company has just put in a rubber belt 260 feet long, 48 inches wide; weight, 2,390 pounds; cost, a little more than $2,000.

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NOVEL HOSE NOZZLE.

The effectiveness of water as a fire extinguisher depends altogether on the manner of its application. If it is thrown in a solid stream and covers only a limited area of the ignited material, its efficiency will be less than it would be if it were spread out over more surface, so as to extend the cooling effect as much as possible. The engraving represents a very effective nozzle for spraying the entire body of water thrown upon the fire, so that an enormously increased area is covered by the water, and this body of water being rapidly converted into steam carries away the heat and reduces the temperature, so that the fire goes out.

The construction of the nozzle will be understood by reference to the engraving, in which Fig. 1 gives the appearance of the nozzle when in use. Fig. 2 is a face view showing the annular spaces for the escape of water, and Fig. 3 is a side view of the nozzle, with a portion broken away to show the internal construction. Exteriorly the nozzle is bell-shaped, and in the mouth of the bell a number of concentric rings are supported by arms held in place by a central stud. Between the several rings and between the surfaces adjacent to the inner and outer ring, there are thin annular spaces, through which the water is projected in conical sheets, which break up into spray and cover a great amount of surface.

The nozzle is simple in its construction and capable of throwing a stream of the most efficient kind for the extinguishment of fires. Mr. Charles Oyston, of Little Falls, N. Y., is the inventor and patentee of this improvement.

Moderate Steam Expansion.

It is no little satisfaction to observe that not a few prominent engineers, who, not quite two years ago, publicly and repeatedly urged the advantage and use of high ratios of expansion have now come around to the view that moderate or low ratios contribute to real economy in steam practice. We do not think it will be many years before it will be generally understood and appreciated that this conclusion applies alike to single and compound engines. For marine purposes compound engines seem to have the advantage of uniformity in the distribution of steam pressure, and other incidental practical advantages, which entitle them to favor, though more than one low pressure cylinder for a high pressure cylinder must be regarded as a fallacy. But compounding is by no means synonymous with the use of high ratios of expansion, and when it is made so, the advantages of compounding referred to above are more than compensated by the uneconomical effects of high ratios of expansion. Triple compounding necessitates the use of too high ratios of expansion, and should be condemned on that account. The best steam engine builders for mill or other stationary power purposes do all they can at the present day to counteract the use of compound engines for such purposes, and only agree to build them when afraid of losing a sale, and after having been unable to convince the intending purchaser of the lack of economy of his project.

The builders of stationary engines are apt to reach correct practical conclusions as to the question of economical working, being forced to reach them by reason of the strong competition existing in stationary steam engine practice. This competition is felt to a much less degree in large pumping engine and marine practice, so that in these branches the recognition of the correct methods for economical working are apt to be reached at a later date. We are, of course, aware of the excellent results, as far as economy of fuel is concerned, which are attained in pumping engine practice, but these results are purchased at the expense of other concomitant greater expenses, so that real economy is not as a fact obtained. These other concomitant expenses are, however, beginning to be more generally appreciated, and the effect of commercial considerations as affecting the use of steam and the economy of steam devices is now preached by those who, two years ago, did not dream of nor care for any such considerations. Efficiency of steam or fluid was then the only watchword in steam engine practice, and all conditions of running or special devices were judged by the degree to which they contributed to such efficiency, independent at all of other considerations. Now, in this country at least, the old standard of current money cost of the power developed, and the economical value of a special method of running or of a special steam device, is judged on the basis of a decrease or increase of the current money expense of the developed horse power.—*American Engineer.*

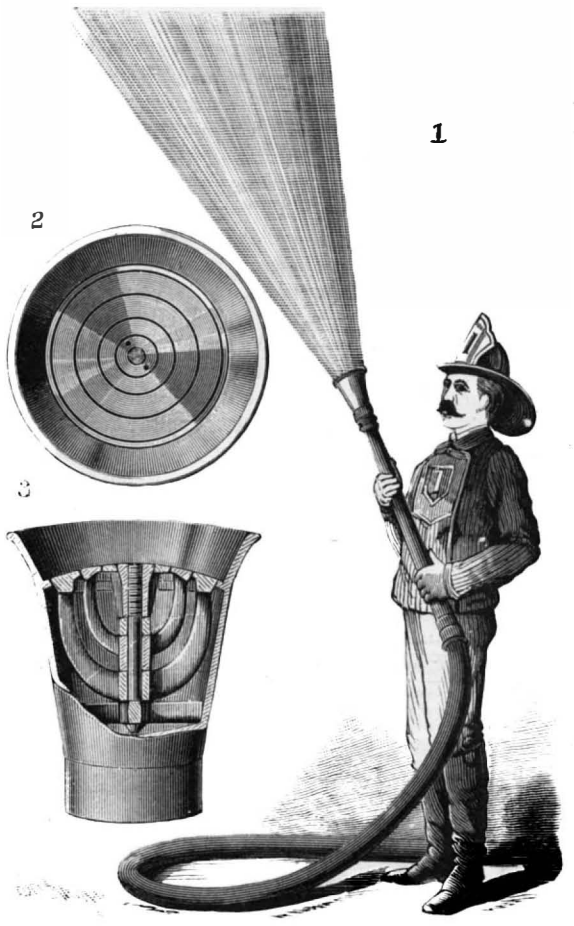
Paper from Bark.

The strongest and commonest of the several Japanese papers is made from the bark of the *Mitsuma*, a shrub which attains about a yard and a half in height, and blossoms in winter, thriving in a poor soil. When the stem has reached its full growth it is cut off close to the ground, when offshoots spring up, which are again cut as soon as they are large enough.

A paper of superior quality is made from the *Kozu*, a shrub of the mulberry family, which grows to the height of two yards and a half. It is a native of China, and has not long been imported into Japan, where it is now much cultivated. The stocks are planted two feet apart, often serving as hedges for separating the fields. The shoots which, under good conditions, attain their full size, are cut down in October, on the fourth or fifth year after planting.

Paper is made with these two descriptions of bark in the following manner: The twigs are steeped in water for a fortnight, when the outer portion becomes detached, and is carried away, if in running water. The inner bark is removed, washed and dried, and then subjected for three or four hours to the action of steam and boiling water, which softens it. It is then struck with staves, until a fine paste is formed, which, mixed with water, serves to make paper by a process similar to that employed in Europe.

Kozu paper is very strong in the direction of the fibers, and to obtain paper of equal resistance in every direction,

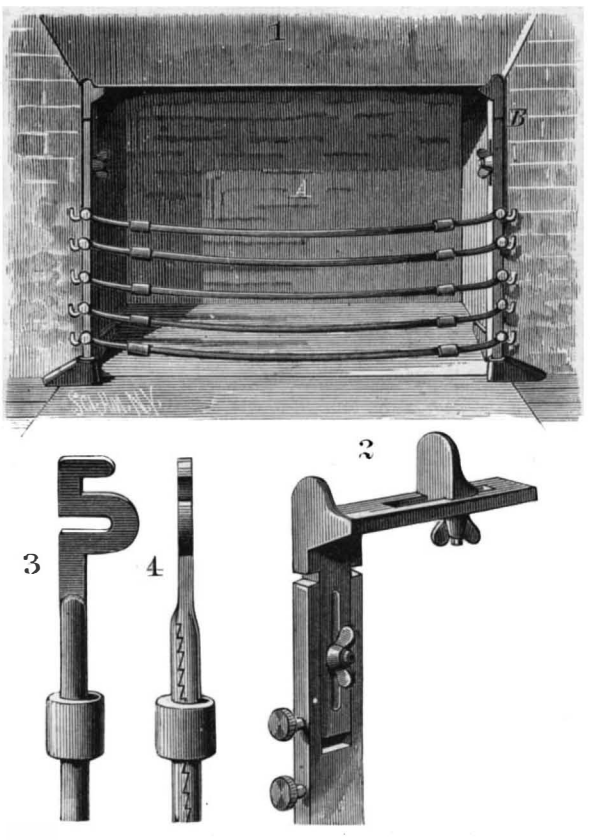


OYSTON'S IMPROVED HOSE NOZZLE.

two, three, or four thicknesses are superposed, with the fibers running in different directions. It is thus that the strong papers are obtained, that serve for covering umbrellas and other similar purposes, as well as artificial leather. The Japanese also make from the *Gampi* a transparent paper as strong as that from *Kozu*, but much finer and more supple.

ADJUSTABLE GUARD FOR FIREPLACES.

The improved safety guard for fireplaces or chimneys shown in the engraving is designed to prevent accidents to children, to keep ladies' dresses from the fire, and to retain the fuel should it from any cause tend to fall outward.



BETTS' ADJUSTABLE GUARD FOR FIREPLACES.

The invention consists of an adjustable stand or support clamped to the jambs on each side of the fireplace, in which are arranged suitable pins or screws, upon which safety or guard rods are supported. These rods are made adjustable (so that they can be applied to different widths of fireplaces) by suitable means.

To the jambs on each side of the fireplace are clamped two standards or supports, provided at their lower ends with feet resting on the hearth. The standards are clamped to the arch or upper side of the front of the fireplace by a clamp, which can be adjusted to suit the different thicknesses of walls by means of a slot and set screw, while at the front side is arranged a small upward projecting lug which fits against the face of the wall.

At the front side of the supports are arranged a number of pins or screws, upon which the guard rods are supported when in position. These rods are made adjustable, so that they may be fitted to fireplaces of different widths.

To prevent sparks from being thrown in a room or apartment and setting fire to carpets, etc., any suitable fender can be placed on the outside of the safety rods.

If desired, the supports, as well as the rods, can be made highly ornamental.

The rods might also be made to conform to the exact width of the fireplace, and be then provided with heads at their ends.

Where this safety guard is used small children cannot get near the fire, the dresses of ladies cannot be drawn toward and into the fire by the draught of the chimney, large sticks of burning wood cannot roll out into the room, and when the wire screen fender is applied sparks cannot be thrown out. This invention has been patented by Mr. Elisha Betts, of Lombardy Grove, Va.

Vanderbilt on Fast Locomotives.

A provincial paper prints a story that Mr. William H. Vanderbilt, the President of the New York Central and Hudson River Railroad, has ordered his master mechanics to devise large and fast locomotives, capable of hauling 15 heavy drawing room cars at the rate of 60 miles an hour. In it the statement is made that he offers a prize of $50,000 for the best plan for an engine that will accomplish this work.

When asked by a *Times* reporter if the statement were correct, Mr. Vanderbilt replied:

"There is no truth in that story. Why," said he, "engines leave the Grand Central Depot every day that haul 13 cars and run at the rate of 60 miles an hour. We are not going to pound the road to pieces by putting on larger engines. If one engine will not haul a train we will put on two, and, if necessary, add more trains; that is all. If a train is run by schedule 40 miles an hour, the rate is 60. Suppose a stop of 20 minutes is made for refreshments, and the train is late. The conductor will wait the full time at the station, and let the engineer make it up. I do believe," said Mr. Vanderbilt, smiling at his supposition, "that if an engine could run 140 miles an hour, and could cover a certain distance at the rate of 30 miles, the conductor would hold the train in order to run at the full 140. If an admonishment is administered, the operation is repeated as soon as your back is turned. No, we have engines that are fast enough."

Preservation of Butter.

Dr. W. Hagemann has been investigating the cause of butter becoming rancid, which is the immediate result of the liberation of butyric acid. He says it is not the result of butyric fermentation, but is due to the formation of lactic acid from milk sugar, which is present in butter to the extent of 0·5 to 0·6 per cent. The lactic acid liberates an equivalent quantity of acids from the glycerides of higher carbon percentage. This, he thinks, explains why summer butter gets rancid more quickly than winter butter, and that artificial butter gives less cause of complaint than natural butter from spoiling.

To preserve butter, one of two methods may be chosen. Either the lower fatty acids are neutralized by caustic soda, which process was perfected by Prof. Adolf Mayer and Dr. Clausnitzer, or care is taken to remove the milk sugar, preventing its decomposition. The decomposition of sugar in cow's butter is caused by lactic acid bacteria, so that the first problem in the preservation of butter is to find some method for suppressing these bacteria.

Electric Lighting in Trains.

The Pullman train to Brighton is now lit with 40 instead of 18 incandescent lamps, owing to the employment of the new Faure-Sellon-Volckmar accumulator supplied by the Electrical Power Storage Company. In the first instance 70 Faure accumulators (original pattern) were required for the 18 lamps, whereas now there are only 30 Faure-Sellon-Volckmar cells used for the 40 lights, their total weight being considerably less than half that of the cells originally employed.

The Next Denver Exhibition.

The National Mining and Industrial Association announce that the next exhibition in Denver, Colorado, will open July 17, 1883, to continue during July, August, and September. The newly elected officers are: H. A. W. Tabor, President; Herman Silver, Vice President; O. L. Haskell, Secretary; Joseph J. Cornforth, Treasurer; and W. A. Loveland, General Manager.

LEONARDO DA VINCI thus foreshadowed the telephone:

"When one is upon a lake, if he puts the opening of a trumpet into the water and holds the point of the tube to his ear, he can perceive whether ships are moving at a remote distance; the same thing occurs if he thrust the tube into the ground, for then, also, he will hear what is going on far away."

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AMERICAN INDUSTRIES.—No. 86.

THE MANUFACTURE OF FIRE BRICK AND CLAY RETORTS.

Most manufacturing industries are final in their results. Their products supply visible needs and enter at once into popular use. Their industrial importance may or may not be great; but, whatever it is, it will not fail of popular recognition. There are, on the other hand, a few industries the magnitude and importance of which only the initiated understand. These industries are at once fundamental and unobtrusive. Their products plays highly important parts in making other industries possible; yet the multitude have little or no knowledge of them, and few appreciate their industrial importance.

Prominent in the latter class of industries is the manufacture of refractory or fire resisting bricks and retorts. Probably not one man in the hundred the country over has any idea of the nature and extent of this business, still less any conception of the number of great and useful manufactures which could not be carried on except with its help. Indeed, there is scarcely a single manufacturing industry of any kind which is not somewhere or somehow contingent upon the labor of the fire brick maker, or which does not to a considerable degree directly or indirectly depend for security or success upon the skill and integrity with which his work is done.

This is especially true of our imposing metallurgical and chemical establishments, our great iron and steel works, glass works, gas works, potteries, sugar refineries, in short, all establishments which require much steam power, or employ high temperatures in any of their processes. The inclosing walls of all furnaces, flues, or other structures for the generation of fierce heats, or the reception or conveyance of heated gases, must be practically infusible; and for this use there is nothing that can economically take the place of fire brick, or other suitably moulded pieces of the same refractory material.

This class of structural materials must not only possess the requisite infusibility for their various uses, but also sufficient hardness and strength to enable them to endure whatever pressure or wear may properly be required of them. As these qualities naturally vary with the quality of the material used, and with the special processes of manufacture employed, it becomes a matter of no little practical knowledge, skill, and care on the part of the manufacturer to adjust the character of each class of products to the requirements of its intended use. A secondary, but not unimportant element of success is exactness and uniformity in the dimensions of the various forms called for, thus facilitating good work on the part of constructors, and insuring economy in the subsequent operations of the furnaces or other structures in the making of which the brick and blocks are used.

The raw material employed in this manufacture is fire clay, the virtue of which depends upon its ability to withstand high temperatures without fusing or weakening. The most refractory clay is that which is substantially a pure silicate of alumina, with but the slightest admixture of iron, magnesia, lime, free sand, or other materials so commonly associated with the clays employed in the manufacture of ordinary brick and stoneware. To give the requisite porosity to the burnt pieces, and to prevent any undue shrinkage or warping of the blocks while being dried and fired, the raw clay is mixed with a variable proportion of calcined clay, more or less finely pulverized. For calcining, the dampened clay is worked into balls or lumps, like loaves of bread, and then dried and burned. Each lump is stamped to distinguish its composition and quality.

Though the specific qualities desired in each kind and grade of articles must be provided for by a skillful choice and blending of the raw materials, the general treatment of the materials is much the same for all. The raw clay is worked to the proper consistency with water, and mixed with the required proportion of burnt clay. The mixture is then passed through a mill carrying spirally arranged knives for more thorough blending, after which it is moulded by power or by hand into the shapes and sizes required, partially dried, pressed by machinery, or accurately finished by hand; and then, after further drying, the pieces are piled in huge kilns and burned.

The engravings on our front page clearly illustrate the manner in which these various processes are carried out in a representative establishment—that of Messrs. Borgner & O'Brien, Twenty-third Street above Race, Philadelphia. Though one of the younger establishments in the trade, having been founded in 1877, this is the most extensive of its kind in the city, and one of the largest in the country. The works extend from Twenty-third Street to the Schuylkill River, a distance of 600 feet, the frontage on Twenty-third Street being 80 feet, and on the dividing street—Davis Street—215 feet. Large shipping and receiving facilities are afforded by a wharf 300 feet in length. The yards are ample for an abundant supply of clay and fuel. The buildings are substantial brick structures, and are fully equipped for the production of superior clay retorts and fire brick for blast furnaces, rolling mills, gas works, cupolas, glass works, chemical works, sugar refineries, tanneries, potteries, lime kilns, greenhouses, boiler settings, and heating and melting furnaces of every sort.

Fig. 1 represents the department devoted to the manufacture of fire brick. The various processes of stamping, mixing, moulding, pressing, and drying are sufficiently indicated in the drawing.

Here are made all the shapes of fire brick in use, all pressed, and all of the standard length, nine inches. The various forms are known as regular brick, arch brick, bull heads, wedges, large and small keys, soap and split brick. The kilns have each a capacity for 30,000 regular brick, or a proportionate number of retorts or other forms. The fuel used in burning is bituminous coal.

The manufacture of irregular forms for special uses is shown in Fig. 4. All these forms are moulded by hand. Beside each workman is placed a heap of tempered clay from which the moulder cuts off as much as the special size he is making may demand. The lump of clay is rolled and beaten, much as a baker kneads a loaf of bread, until it is homogeneous throughout and free from cracks or open spaces. The moulds are made of stout planking, and are strongly strapped with iron bands. The moulder sprinkles the inside of the mould with sand to prevent the sticking of the clay, inserts the lump of kneaded material and beats it down thoroughly. Then with a sweep of a wire cutter he trims off the surplus clay, smooths the face of the block with a broad thin blade of steel, and with a dexterous turn empties the mould upon a drying table where the block remains until it is dry enough for finishing. The blocks which the moulders are handling in the cut are to weigh 80 pounds each when burned. In their raw condition they carry a large percentage of water, and with the weight of the mould in addition give the moulder something to handle which severely taxes the strongest wrists. Yet these blocks are not nearly so large as others which are moulded in this way. The largest pieces made in this department weigh upward of a ton each, and require, of course, several men to handle them. After standing on the drying floor until they are firm enough to retain the final shaping and finishing, these blocks are beaten and smoothed into the precise form required, allowance being made for shrinkage; then they are set aside for more thorough drying before they are fit for the kiln. The shrinkage in burning is about three-fourths of an inch to the foot.

The work of this department is constantly increasing in scope and variety, and calls for the highest skill in the mixing, manipulating, and burning to insure exact and uniform agreement of quality and finish to the particular uses to be provided for. The products of this and the preceding department go to all parts of the country, and are often shipped abroad. The proprietors justly pride themselves upon the excellence and uniformity of their productions, the result of untiring efforts to excel, long practical experience, and a determination to turn out only the best work at reasonable prices. Purchasers have the further advantage of a large and varied stock to select from, a matter of no small convenience and saving often to those who are building or repairing.

Fig. 2 shows the manner of moulding and handling retorts. These large pieces are moulded on end; and from their great size and fragility when ready for burning, and the necessity of having them entirely uniform in structure and quality in every part, they demand the highest skill and care at every stage in their production. The kilns are on the right. The shop for making the moulds for these and other pieces is on the floor above.

The large retorts shown are used in gas making. They are 9 feet long, 26 x 15 inches in section, and, when burned, weigh a ton. An essential requirement of these retorts is that they shall be exceedingly refractory, or able to endure the highest temperatures; and it is to their success in meeting this requirement that this firm attribute much of the rapid development of this part of their business. They have devised and introduced many improvements in the machinery and processes employed in the manufacture of their specialties, and are confident that there is no establishment of the sort more complete than theirs in its appointments or better adapted for turning out first class work. That it does turn out such products is attested both by the rapid extension of the business of the house and the fact that they have always received the highest awards when their manufactures have been exhibited in competition with others.

Fig. 3 represents the exhibit of Messrs. Borgner & O'Brien at the recent International Exhibition at Atlanta. From the first their aim has been to merit the confidence of users of this class of materials by prompt, uniform, and thoroughly reliable work; and the large number of orders already entered for the opening season clearly indicate both a busy and profitable year, and the appreciation with which good work is received by purchasers.

The firm comprises Mr. Cyrus Borgner and Mr. William J. O'Brien.

Synthesis of Uric Acid.

The first organic body ever produced artificially was urea, and the last that has been formed synthetically is uric acid, also a constituent of the urine, but of much more complex construction.

The first was accomplished by the late Prof. Wöhler, the last by John Horbaczewski, in the laboratory of Prof. Ludwig, in Vienna. The operation is thus described by him in the *Berichte* of the Berlin Chemical Society:

Pure and finely pulverized glycocol, obtained from hippuric acid, was mixed with ten times its weight of pure urea made from cyanate of ammonia. The mixture was heated rapidly in a flask on a metal bath to 200° or 230° C. (392° to 446° Fahr.). The heating was continued until the fusion, which was at first perfectly clear and colorless, became turbid and thick, and of a yellowish-brown color.

When cold, the fused mass was dissolved in dilute caustic potash, the solution was supersaturated with chloride of ammonium, and then precipitated by an ammoniacal silver solution mixed with magnesia mixture. The precipitate, which contains the uric acid, was well washed with ammonia water and then decomposed with potassium sulphide. After filtering out the precipitate, the filtrate was saturated with hydrochloric acid and concentrated by evaporation. The crude product that separated on cooling was again dissolved in dilute potash, and the same process twice repeated. The final product was a yellowish colored crystalline powder, which was washed with alcohol first, then dried and the sulphur removed with carbon disulphide, and finally washed with ether. The product purified in this way showed all the properties and reactions of uric acid.

1. Under the microscope the crystals exhibited the forms characteristic of uric acid, either plates or whetstone-shaped crystals according to the purity of the preparation.

2. They reduced alkaline copper solution when heated, and the silver solution without heating.

3. They dissolve in warm concentrated nitric acid with the evolution of brown vapors, and the onion-red residue left by evaporation (murexide test) turned purple with ammonia, violet with potash.

4. They were very slightly soluble in water, acids, alcohol, and ether; but easily soluble in caustic alkalies.

An elementary analysis gave the following result:

	Calculated.	Found.
Carbon	35·72	35·68
Hydrogen	2·38	4·02
Nitrogen	33·33	33·49

The author reserves the privilege of studying more fully the reactions which he communicates.

We may say, by way of elucidation, that the glycocol (or glycocine) employed is an organic base having the formula $C_2H_5NO_2$, made by boiling hippuric acid for half an hour with strong hydrochloric acid. It is also formed by the action of potash on gelatine, hence called sugar of gelatine. Uric acid has the formula $C_5H_4N_4O_3$, and urea simply CH_4N_2O.

On the Chemistry of Hay and Ensilage.

At a recent meeting of the London Chemical Society, Mr. Toms read a paper as above. The author has analyzed various samples of hay, and contrasted them with analyses of "ensilage"—*i. e.*, grass buried while green in a water-tight pit or "silo," and subjected to pressure. It is well known to chemists that hay making is not a mere drying of grass, but that a fermentation also takes place, which develops the well-known perfume of hay, and during which the grass loses its green color. A specimen of good hay dried contained:

Fatty matters	2·17
Free acetic acid	1·89
Sugar	3·42
Starch	12·46
Gum and mucilage	27·25

A specimen of brown hay from the same rick as the last, but from a portion of the stack which had heated, contained:

Fatty matters	4·26
Aldehyd, which formed a mirror with ammonio-silver nitrate,	trace.
Free acetic acid	5·38
Sugar	6·94
Starch	3·42
Gum and mucilage	24·77

More than two-thirds of the starch had thus disappeared, and apparently had been converted into sugar, etc. Three specimens of ensilage were examined. One differed very little from ordinary grass. The second was brown, and smelt strongly of tobacco; it contained more acetic acid and sugar, but less starch. The third specimen represented fodder which had been buried eighteen months; it still contains starch-sugar, but was not acid, and was mouldy.

Mr. O'Sullivan did not think that the author had proved the presence of starch in the hay and ensilage, because other substances, such as gum and mucilage, when boiled with dilute sulphuric acid, furnished cupric oxide reducing substances.

Dr. Gilbert said during his recent visit to America he had heard a good deal about "ensilage," and the process seemed to be thought much of in that country. The crops, too, of succulent maize, etc., seemed well suited for it. It was essential for a good result to put all the materials as quickly as possible in the "silo," and put on a pressure of 100 to 150 pounds per square foot almost immediately. He suggested that unless samples of ensilage taken for analyses were kept under pressure during transit the product might be completely changed. The process was very suitable for the preservation of the pulp from the sugar beet.

Mr. Samuel Marsden on the Parallax.

This gentleman writes as follows to the *Republican*, of St. Louis:

"From a recent mathematical investigation I find the parallax, or angle that the earth's semi-diameter would appear under, if viewed from a distance equal to the mean distance of the sun, to be 8·9783025046 etc. The following data being used: The sun's mean apparent diameter, 1924·53, obtained from the "American Nautical Almanac" for 1881. The value of one second of arc, 206264·8097655628. I find the sun's mean distance to be 90,888,543 (plus) miles, and his diameter 848,025 (plus) miles."

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Correspondence.

Underground Steam Pipes.

To the Editor of the Scientific American:

I have been a reader of your valuable paper for several years, and, for a still longer period have been interested in practical arrangements for the use of steam for many purposes; for power, for the warming and ventilation of buildings, for cooking, etc. I am, therefore, prepared to look favorably upon plans for such extension of its use as the interest, convenience, or necessities of men may suggest or dictate.

In accordance with this feeling, my attention was arrested by the earliest movement in favor of the project, as it was then properly called, to lay wrought iron pipes underground, for the transmission of steam for various practical objects.

I have, however, regarded the project as quite impracticable, and now regret that I have so long delayed a statement of facts and an expression of my views in regard to it. The subject has three interesting and important aspects. The first is that of the cost of the original "plant," and for repairs afterward to the projectors and owners; the second, that of utility and convenience to parties who use the steam for whatever purpose; and third, the effect on the public convenience, in having the surface of streets and sidewalks pierced, in first laying and afterward in the repair and renewal of the fixtures, when they are damaged and become leaky. Apparently, the parties concerned in placing these fixtures are doing what they can, and perhaps all that is possible, to protect the exterior of the pipes from injury from rust and other causes, and to prevent undue condensation of steam in passing through them. They, however, appear to ignore the fact that the serious wear of wrought iron pipes used for steam, and their early failure, result from scale and corrosion of the internal surface. This arises from the fact that the iron is laminated, and subject, under the influence of varying temperature, to lose or throw off minute scales, which, of course, diminishes the thickness of the pipes and causes an uneven surface, which is followed by more rapid wear from the corroding and cutting influence of the steam than when perfectly smooth. The same kind of wear also occurs at the joints where two pieces are coupled together by sockets. The thickness of pipes at these points is diminished by having a thread of screw cut upon them exteriorly, while the uneven surface within renders the steam more effective in cutting away what remains of the thickness of the iron. From these and perhaps from some other causes (the natural imperfections of the internal surface of the iron among them), the deterioration from within is rapid, and the durability of the pipe in the most favorable circumstances is often limited to from four to six years.

When a fault occurs it must receive early attention to prevent a rapid increase and consequent loss of steam by leakage. When pipes are situated so as to admit of constant or frequent inspection and so as to be easily accessible for repairs or removal, the work is easy and inexpensive, and the use of wrought iron pipe for conducting and condensing steam is a thoroughly practicable matter. But, if the leaky pipe is situated three or four feet below the surface of frozen ground, and that ground a public thoroughfare of a great city, the cost to the owner of making repairs or renewal would be very great, the inconvenience to the user of having the supply of steam cut off for a day, or even a few hours, will be of still greater importance, while the frequent and more or less prolonged disorder and disuse, partial or general, of streets, will be, to the public, an embarrassment and eventually, as scores and hundreds of miles of pipes become honeycombed and leaky, an intolerable nuisance.

To show you how certainly the end foreseen and predicted will occur in the way described, I send for your inspection samples of wrought iron pipe, of various sizes and in various stages of impairment, from the causes named, and that have occurred within from four to five and six years' use. Specimens of this kind can be multiplied indefinitely from the stock of any large establishment using steam pipes; but, of course, it is unnecessary for me to do this to convince the practical men of your house of the truth and importance of my statements.

Although much has already been done and a large expense incurred to inaugurate the system, yet it may not even now be thought too late to present the subject for individual and public consideration. That the system will, in the end, prove a blank and disastrous failure I am perfectly sure.

H. A. B.

Morris Plains, N. J., January, 1883.

[The points raised in this letter are correct, and the inferences and conclusions well known to all steam engineers who have much to do with pipes of *wrought iron* for steam and hot water circulation. The specimens sent fully confirm the writer's statements.—ED. SCIENTIFIC AMERICAN.]

"How Fire Sweeps a Wooden House."

To the Editor of the Scientific American:

On page 325 of SCIENTIFIC AMERICAN, November 18, 1882, I find an article with the above caption, and at the end of the article a remark by the "Ed. S. A." to the effect that he who suggests a plan to build frame houses so as to avoid the spread of fire will deserve well of his fellow men.

Here is the plan: Let corner and center posts extend from sill to roof plate. Let plates of 4x4 or 4x6 timber be framed into these at height of second floor and at height of upper ceiling in outside wall, and for every partition. Now frame in all braces and studding of outside walls. Set the outside door and window frames, and weather board and cover. Next lay all floors solid or without breaks from outside to outside. Next frame in the partition studding, toe nailing to the floor and to the partition plates. The second floor joists will rest on first set of plates. The upper or third floor joists will rest upon second set of plates. The weather boarding will be nailed to these plates outside. The plastering laths and the plastering will touch them on the inside around the top of each room.

Now, let fire start between two studs in lower story. It will be seen that it cannot pass to second story till it burns through the weather boarding and up the outside or through the plastering into a room, and then through the ceiling and second floor. Let a fire start in second story. It cannot get below till it burns through the floor. Nor can it get to the roof till it burns through the weather boarding, or through the plastering and upper ceiling.

Let it start in roof. It must burn its way through upper ceiling before it gets to second story, and through second floor before it touches the first story.

This is easy, and it seems to me that with spaces between joists closed, it brings a fire in such a house about within control. I live in a house so constructed.

J. C. HODGES.

Morristown, Tenn., January 6, 1883.

Power versus Hand Drilling on Lake Superior.

Mr. Frank Klepetko, of the Northwest Mine, now belonging to the Conglomerate Mining Company, of Philadelphia, has furnished the Commissioner of Mineral Statistics of Michigan with some interesting figures on the comparative cost of drifting by hand and by power drills on the amygdaloid of that mine. These will supplement the data which we printed in our issue of August 29, 1882, page 221, on the comparative cost on conglomerate rock.

The following table gives the comparative cost of drifting on amygdaloid:

Items.	Drifting by hand.	Drifting with power drills.
Day's labor per foot (men)	$4.79	$2.18
" " " (boys)	—	.53
Contract cost per foot	11.95	10.04
Cost supplies per foot	2.07	4 12
Less profit on supplies, 25 per cent	.52	1.03
Net contract cost per foot	11.43	9.01
Compressor cost per foot	—	1.64
Interest on compressing plant	—	.62
Total cost per foot	11.43	11.17
Wages earned by miners, per day	2.06	2.50
" " " boys "	—	.96

The wages were high because the mine, at that time, in 1880, had not been working regularly, and better rates had to be offered to induce men to work. The compressor cost includes repairs on compressor and drills, wages of the men running the compressor, fuel, oil, packing, etc. The cost per foot drifted was obtained by dividing the compressor cost for the seven months that the Rand drills were running, by the entire number of shifts worked by the miners with the drills. This quotient was multiplied by 2·18, the number of shifts to each foot drifted. The cost is high because the full number of drills was not run continuously; but, on the other hand, the repairs were light. The interest on compressing plant was obtained by reckoning interest at 10 per cent for seven months on $15,000, including the whole plant and 10 drills. In 104 shifts, in one month, the advance was 21·07 feet for drifting by hand, and 47 07 feet by drills, or 2·2 times as much. The apparent saving is 26 cents per foot in favor of the drills, not taking into account the increased speed. This reduces the fixed expenses, such as salaries, pumping etc., equal to a saving of $3,000 per annum. An allowance must also be made for the fact that the hand drifts are carried through 6 feet by 5 feet, while the machine drifts are 7 by 8 feet or more. In ore-bearing ground this amounts to an increase of excavation of from 3,000 to 5,600 cubic feet of rock per 100 feet of drift run, or 12 cubic fathoms. In the case of the Northwest, this would amount to $15 per cubic fathom, or $1.80 per lineal foot, which would reduce the cost of drifting with power drills in ore ground to $9.37 per foot, or $2.06 less than hand drifts.

The following figures show the comparative cost of stoping with Rand drills when the work is done by contract by the fathom or by contract by the foot of hole drilled:

	By fathom, contract.	By length of hole, contract.
Day's labor per fathom (men)	$2.38	—
" " " " (boys)	.98	—
" " " " (miners)	—	$1.71
" " " " (blasters)	—	.35
" " " " (boys)	—	.60
Contract wages per fathom stoped	5.54	3.30 (cost of holes)
Wages paid to blaster and helper	—	1.06
Supplies used by miners	5.77	.33
Supplies used by blasters	—	6.21
Compressor cost per fathom stoped	1.79	1.28
Interest on compressor plant	.67	.48
Total cost per fathom stoped	13.77	12.76
Less profit in supplies, 25 per cent	1 44	1.63
Net cost per fathom	12.33	11.03

In contracts per foot of hole drilled (12 cents per foot) the miners furnish light and the oil for the drill, while the company pays for power drills, caps and fuse, and hires the charger, who measures the depth of the hole when he inserts the charge. In contracts by the fathom, the men pay for all the supplies, and the company only furnishes the drills and the power to run them. By the latter method the men earn $1.93 per day, as against $1.68 by the former; the quantity of rock broken per drill and four men being 43·7 for the fathom contract to 60 8 for the other.

Useful Recipes.

SIRUP ORANGE PEEL, FRESH.

Fresh orange peel	℥ii.
Alcohol	℥ii.
Aqua pura, q. s. to percolate	℥ix.
Sugar	℥xiv.

Cut the peel in small pieces; put in mortar and add the alcohol; thoroughly bruise to a pulp; put in a glass percolator; add the aqua pura until 9 ounces have percolated; put the sugar in percolator, and percolate the menstruum through the sugar until dissolved.—*E. H. Hollisten, in Pharmacist.*

TONIC BEER.

Plain sirup, 22° Baume	5 gallons.
Oil of wintergreen	2 drachms.
" sassafras	2 "
" allspice	½ drachm.
" sweet orange	2 drachms.

Mix the oil with 12 ounces of alcohol and add to the plain sirup. Then add 35 gallons of water at blood heat, and ferment with sufficient yeast. To this add 1 drachm of salicylic acid dissolved in conjunction with 1 drachm of baking soda in a small glass of water. After it has ceased effervescing, add to the fermenting beer. The object of using this minute quantity is to prevent putrefactive fermentation. The natural vinous fermentation will not be obstructed by it.—*American Bottler.*

PERFUME FOR VIOLET POWDER.

Bergamot oil	20 parts.
Lemon oil	20 "
Clove oil	10 "
Neroli	10 "

Use equal parts of powdered orris root and starch, and add 1 drachm of this to each pound of powder.—*Druggists Circular.*

FLORIDA WATER.

Oil of lavender	4 ounces.
" bergamot	4 "
" cinnamon	2 drachms.
" cloves	1 drachm.
" neroli	2 drachms.
Pure musk	4 grains.
Cologne spirits, 95 per cent	1 gallon.

Macerate fifteen days and filter through paper.

TRANSPARENT GLYCERINE SOAP.

Twenty pounds of fresh tallow and 10 pounds of best cocoanut oil are heated to 167° Fahr. On the other hand, 15 pounds of solution of caustic soda of 40° B., or specific gravity 1·384, 12 pounds of 96 per cent alcohol, 15 pounds of glycerine, 6 pounds of brown sugar, and 2 pounds of water are mixed, likewise heated to 167° Fahr., and the mixture gradually mixed with the former, under brisk stirring. Saponification takes place in this manner, without the necessity of boiling. The reaction is accompanied by a considerable increase in bulk. It may then be covered, and after it has become a little cooler, it may be scented; finally, it is transferred to moulds, which must be so placed that the soap can congeal quickly.—*New Remedies.*

How Dimples are Made.

This is the way dimples are manufactured in Chicago, if a reporter of the *Herald* of that city tells the truth:

"My arm being bare and the exact spot indicated, he (the operator) placed a small glass tube, the orifice of which was extremely small, upon the spot. This tube had working within it a piston, and was so small that when the handle was drawn up the air was exhausted from the tube and it adhered to the flesh, raising a slight protuberance. Around this raised portion the operator daintily tied a bit of scarlet silk, and then took away his suction machine. The little point of skin that was thus raised he sliced off with a wicked looking knife, bringing the blood. I tried hard not to scream, but it was so unexpected that I had to. Then he bound up the arm, placing over the wound a small silver object like an inverted cone, the point of which was rounded and polished. This little point was adjusted so as to depress the exact center of the cut. Then he told me to go away and not touch the spot until the next day. When I came at that time he dressed my arm again, and this operation was repeated for five days, when the wound was healed. The silver cone was removed, and there, sure enough, beneath it was the prettiest dimple in the world! And all I had to pay was $10."

For Fence Posts.

A writer in an exchange says: "I discovered many years ago that wood could be made to last longer than iron in the ground, but thought the process so simple that it was not well to make a stir about it. I would as soon have poplar, basswood, or ash as any other kind of timber for fence posts. I have taken out basswood posts after having been set seven years that were as sound when taken out as when first put in the ground. Time and weather seemed to have no effect on them. The posts can be prepared for less than two cents apiece. This is the recipe: Take boiled linseed oil and stir in pulverized coal to the consistency of paint. Put a coat of this over the timber, and there is not a man that will live to see it rot."

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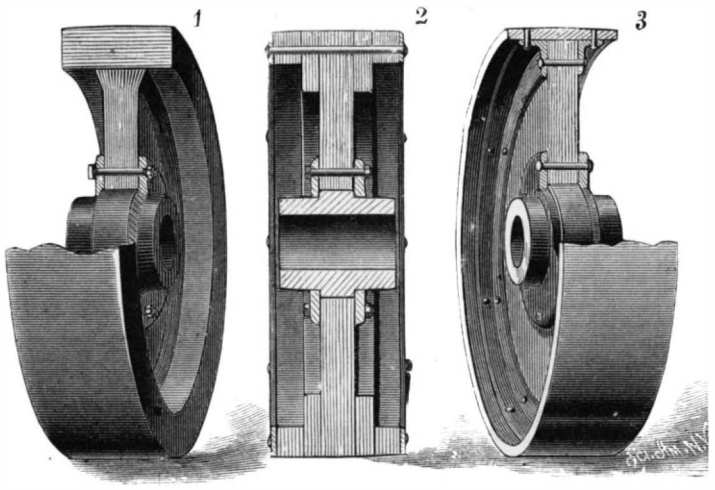
THE AMERICAN PAPER PULLEY.

This invention has attracted much attention among manufacturers for the past few months. The strength and inflexibility of paper, when pasted or glued together in blocks, and subjected to heavy pressure, had been fully tested in the paper car wheel, and it is singular that inventors have been so tardy in discovering its utility in the construction of belt pulleys. On the 31st of last October, three patents were granted to E. B. Martindale, of Indianapolis, Ind. One for a composite pulley, formed of a cast iron hub, a web or body made of paper, pasted and pressed into a solid block, of the thickness to give it the required strength, and this web surrounded by a wrought or cast iron rim, secured to the web by means of knees or flanges riveted through the rim and the paper. By actual tests, it has been found that the rim having a uniform bearing upon the paper body, it is more steady, even, and perfect than any iron pulley heretofore made. The other two pulleys patented by Mr. Martindale, are, with the exception of the hub, made entirely of paper. One is made with a web or body the same as that used for an iron faced pulley, the web forming a part of the face. Paper or pasteboard is then cut into rings and pasted and pressed upon either side, of sufficient thickness to make the required width of face. The rim thus formed is riveted solidly, and turned up to receive the belt. The other is made in much the same manner that paper vessels are made by pasting and pressing sheets of paper, or by rolling and calendering the same together in shape required for the pulley. The engravings represent these pulleys.



THE AMERICAN PAPER PULLEY.

These pulleys are now in use, and a factory established by the American Paper Pulley Company, for making them at Indianapolis. The inventor claims for the paper pulley that it possesses the following advantages:

1. Cheaper than either wood or iron. 2. Less liable to break than iron, and does not warp or come apart like wood. 3. It is less than one-half the weight of iron, relieving the line shaft of extra weight and friction. 4. The belt never slips upon it, and may therefore be run much looser than upon an iron pulley, thereby, it is claimed, saving 25 per cent of power.

The Bull Direct Process.

A process for manufacturing iron and steel directly from the ore, invented by Mr H. C. Bull, is attracting some attention in England. The furnace is worked exclusively with gas, delivered into it in a very highly heated state directly from the producers. Highly heated air is also introduced in sufficient quantities to burn about 10 per cent of the gas, and maintain the furnace at the high temperature necessary to allow the withdrawal of the iron or steel and cinder in a fluid state. Under this system, the gases rising through the ore and flux are carbonic oxide and hydrogen, in equal volumes, together with the nitrogen derived from the air which is blown into the furnace. These gases being produced entirely outside the furnace, there is no zone of gasification, but only the zones of fusion, reduction, and carbonization.

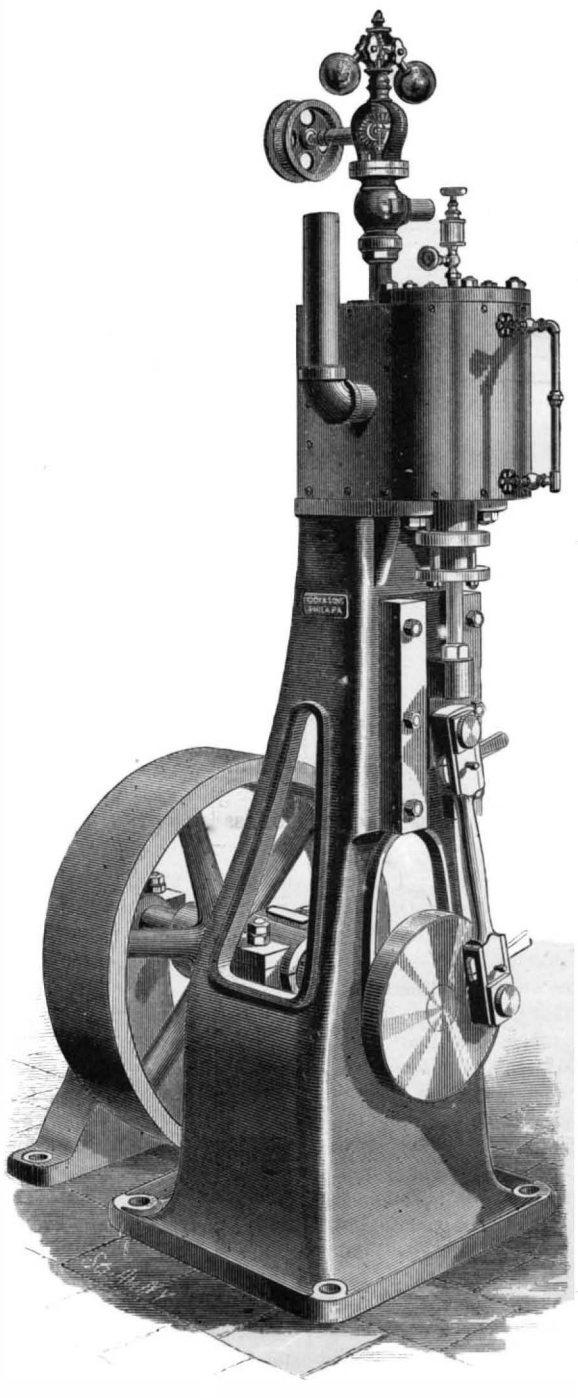
During the year 1881, the Société John Cockerill, of Seraing, Belgium, built an ordinary blast furnace 6 feet in diameter in the bosh, and 21 feet high, fitted with Cowper hot air blast stoves, and ordinary water gas producers of the cupola type, when 3,534 kilogrammes of iron were produced in twenty-four hours, under this process with the gas, as against 645 kilogrammes by means of the ordinary blast furnace without the gas. The silicon was reduced from 3·40 to 0·15, the sulphur from 1·61 to 0·33, the phosphorus from 1·76 to 1·10, the manganese to *nil*, the combined carbon to 0·52, and the graphite to 0·17, which proved that the mildest grades of ingot iron and steel, suitable for rails, cutlery, and the highest class tools, could be produced from the most inferior ores directly in the blast furnace. At the same time, the output from the furnace was increased enormously, and the quantity of fuel required was decreased in almost the same ratio.

A Safe Safety Lamp.

M. Marsaut, member of the Société de l'Industrie Minerale de Saint Etienne, has been experimenting with various so-called safety lamps, especially the Mueseler, with a view to ascertain why it is that they do not afford an absolute guarantee of safety. He found that, in a state of repose in an explosive mixture of air and gas, the explosion which takes place under the diaphragm of the Mueseler lamp, and which generally extinguishes it, passes through the diaphragm on an average fifteen times in a hundred, and communicates the explosion to the exterior almost once in every hundred times. The number of times that the flame passes through the diaphragm is nearly fifty per cent of this number in a certain series of tests, and explosions occur on the outside in five per cent of the cases. This discovery easily accounts for many accidents, the causes of which have until now remained a mystery. As the results of these investigations, M. Marsaut has constructed a modified type of lamp in which no less than 5,500 explosions have taken place without their being communicated to the outside, and under conditions in which the other lamps, including the Mueseler, failed to stand the test. The special feature of this new lamp is a metal shield formed by a hollow cylinder of sheet iron, closed at the top by wire gauze, which completely surrounds the ordinary gauze of the lamp. At the lower portion of the shield is a series of apertures which permit the air necessary for supporting combustion to enter the lamp. This air, in order to reach the flame, must follow a tortuous course, and thus the danger caused by oblique, downward, and rapid currents is completely neutralized. The horizontal diaphragm, which is one of the characteristics of the Mueseler lamp, is suppressed, and is replaced by a simple washer for supporting the chimney. A wire gauze with 929 meshes to the square inch completely envelops the chimney of the Marsaut lamp, and takes the place of the diaphragm in the Mueseler.

IMPROVED VERTICAL ENGINE.

The engine shown in the annexed engraving is of original design, built from new patterns in a thorough and substantial manner, and is so arranged that all of the parts are readily accessible. The engine frame is rigid, and the engine is self-contained and very compact. All of the important parts are made of steel, and the journal boxes and other wearing parts are of the best brass. Wherever there is wear there is a suitable adjustment for taking up lost motion. The main shaft is extra large, and has long bearings. The cylinder is provided with the usual drain cocks and stop valve, and the engine has a governor, and is provided with oil cups wherever they are necessary. The base is very firm, so that no special foundation is necessary in order to set up one of these engines. We are informed that they are all tested with steam before leaving the works. They are made in several sizes, viz., 4, 6, 8, and 12 horse power, with cylinders 4 x 6, 5 x 7, 6 x 8, and 8 x 10 respectively; also a 10 x 10. Larger sizes are in process of construction. This engine is in all respects first class, and well calculated for every-day use the year around. The first three sizes are mounted on a base with the boiler if desired, making a very complete and compact engine.



COX & SON'S VERTICAL ENGINE.

Further information may be obtained by addressing Messrs. Cox & Son., 204 North Fourth St., Philadelphia, Pa.

The Strontia Beds of Sicily.

The introduction of strontia into the sugar industry in recent times has brought this comparatively rare mineral into considerable importance, especially where beets are used for making sugar. Most of the mineral comes from Sicily, and the following description by one who has been there, and taken from the *Chemiker Zeitung*, will be read with interest:

At present all the celestine that is exported comes from Favara, near Girgenti. There the strontium sulphate is found on a high plateau of considerable extent, in the strata of the lower miocene, which, in Sicily, usually carry sulphur. They consist of limestone, calcareous marl, and gypsum, through which is scattered the sulphur, mostly in a finely divided state, more rarely in pieces as large as peas or nuts. At Favara the sulphur is almost entirely missing, and the limestone is partially replaced by strontium sulphate. The stratification of the rocks is almost horizontal there, and the top strata are much weathered and decomposed. The lighter minerals are washed away by the water, while the celestine, being heavier and less acted upon, is left in blocks on the surface. The latter differs but little in appearance from the accompanying limestone, but can be easily distinguished even by the inexperienced from its greater specific gravity (3·9), which has gained for it the name of *cu chiummo* (*come piombo*, like lead) in the dialect of the people.

At present only the mineral that lies exposed is collected, no mining operations being undertaken to obtain it. The inhabitants bring it to several stations on the Palermo and Girgenti Railroad, where it is bought up by dealers at about $7 per ton. At Porto Erupedocle it is again sorted, and any adhering gangue removed, and then it is shipped to Hamburg, or other foreign ports.

The export in 1880 was only 1,000 tons, and in 1881 about 4,000 tons. A factory is being built at Rosslau, in Alsace, for converting the Sicilian mineral into caustic strontia and its carbonate.

No strontianite—*i. e.*, strontium carbonate—is found in Sicily.

Chemistry of the Electrical Accumulators.

With the attention that is now directed to the storage of electricity, the following description of the *chemical* action of the Plante and Faure accumulator as given in a German exchange will not be without interest.

If a plate of lead, coated with a little peroxide of lead, be placed in sulphuric acid, it will soon become covered with sulphate of lead as a result of local currents between the peroxide and the lead, or by simple chemical solution, so that in Plante and Faure's battery the peroxide is gradually destroyed *independently* of the main current. This action takes place very slowly, because the sulphate of lead is deposited between the lead and the peroxide, and hence greatly diminishes the local current. If no sulphate of lead were formed, the peroxide of lead would soon be all consumed. The sulphate of lead is subsequently reduced by the hydrogen, forming spongy lead. By repeated charging, the quantity of finely divided substance increases.

In a similar manner, if two electrodes that are covered with sulphate of lead be immersed in dilute sulphuric acid, and a current passed through them, one will become covered with spongy lead, the other with peroxide formed from the sulphate.

The peroxide formed upon the positive lead plate of the secondary battery becomes covered with a comparatively impenetrable layer which prevents the further production of peroxide; hence Plante leaves his battery at rest, which favors this formation of sulphate of lead.

In this way all the sulphuric acid can easily be taken out of the solution. A considerable quantity of oxygen—more than half—will not be absorbed. According to Kabath, the interior plates of lead foil are rapidly crumbled, but the particles remain hanging between the outer plates.

A Large Gold Bar.

The Bank of California lately received a bar of gold weighing 511½ pounds troy, and valued at $114,000. Its length was 15 inches, width 6 inches, depth 7 inches. It was shipped by the North Bloomfield Hydraulic Mining Company, of Smartsville, Nevada County, California, and is said to have been the largest gold bar ever cast in the United States.

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A GLASS BLOWING MACHINE.

The growing demand for glass bulbs and mercury pumps, created by the introduction of the electric incandescence lamp, has called into existence a very ingenious apparatus for shaping heated glass much more quickly and effectively than can be done by the hand and mouth of the ordinary skilled glass blower. The new machine is the joint invention of Mr. Frank Wright and Mr. M. W. W. Mackie, electrical engineers, London, and is likely to prove of great value in reducing the cost of incandescence lamps. It is so simple in its action, and does the work so well, that we are forced to wonder why a similar machine has not been invented before. Perhaps, however, the demand for plain bulbs and glass tubing for scientific purposes was never till now sufficient to lead inventors to the problem.

The action of the machine will be understood from the illustrations, Fig. 1 being a side view, Fig. 2 a plan, and Fig. 3 a transverse section, along Z Z. On a metal bed like that of an ordinary lathe are fitted two headstocks, B and C, one of which, B, is fixed, while the other, C, is capable of being slid to and fro by a rack and pinion worked by a handle, D. Each headstock is fitted with a tubular mandrel, E and F; the mandrel, E, being revolved by a belt from a motor, and F being also revolved at the same speed by gearing from E.

The gearing for this purpose consists of a horizontal spindle, G, carrying a pinion, *e*, driven by a toothed wheel on E, and another pinion, *f*, driving a toothed wheel on F. The pinion, *f*, is fitted with a key or feather on the spindle, G, so that it must revolve with it, but may slide freely along it with the headstock, C.

At the end of each headstock is fixed a tube, H and K, closed at their outer ends, but communicating freely with the respective tubular mandrels, and to each of the tubes, H and K, there is a communication by a flexible tube, *h* and *k*, from a reservoir of compressed air, each communication being provided with a cock or valve, enabling the operator to open or close it at pleasure.

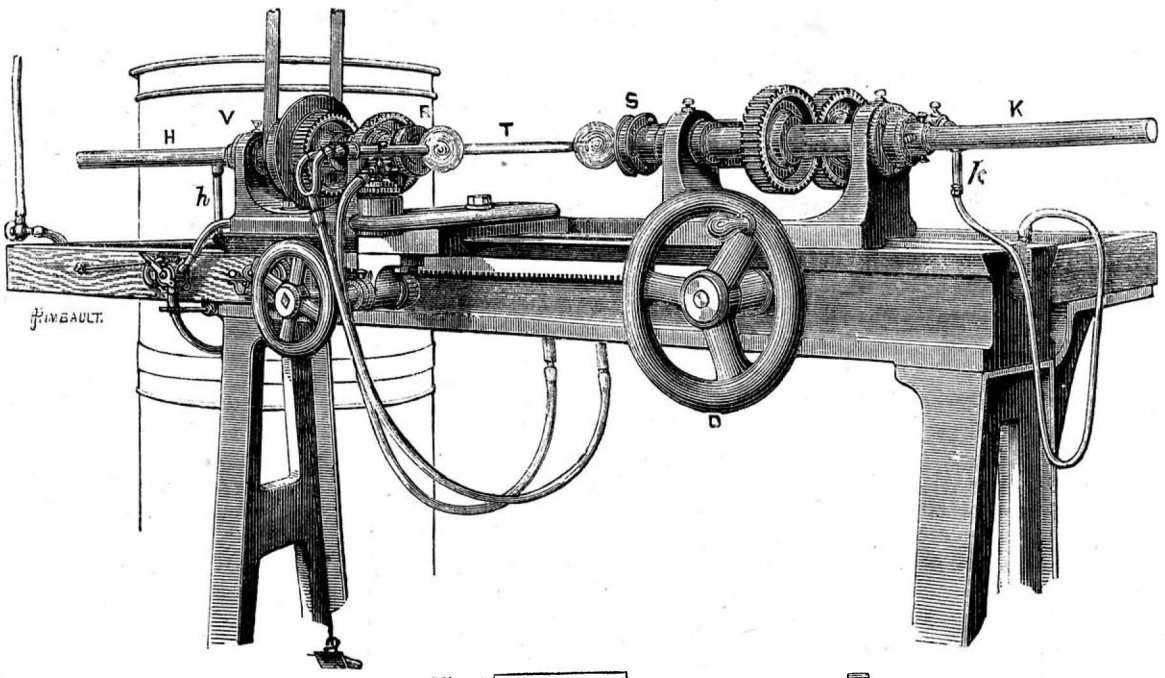
Between the two headstocks, B and C, is fitted a slide, M, which can be moved along the bed of a rack and pinion worked by a handle, N. On the slide is fitted a transverse slide, O, carrying a blowpipe, P, which may be double, as shown, and supplied with gas and air by flexible pipes, *p*, provided with valves and stopcocks to regulate the blast. The blowpipe turns on a vertical axis on the slide, O, enabling the flames to be directed on the glass at any angle.

Each mandrel, E E, is fitted with a chuck, R S, at its inner end, to grasp the glass tubes inserted into it. The chucks are lined internally with soft elastic packing, such as felt or caoutchouc, and are arranged to clamp a tube without straining it unequally, while at the same time it prevents the escape of air from the hollow mandrel. The body of the chuck is of iron, which dissipates its heat rapidly, and shuts up square on the glass tube inserted.

To work the machine a glass tube or rod, T, is inserted into and clamped in the two clutches, R S, and caused to revolve by starting the mandrels. The blowpipe flame is then directed on any part of it, and the heated part is drawn out thinner or pressed in thicker by moving the headstock, C, away from or toward B. By admitting air under pressure into either or both of the pipes, H K, the glass tube can be blown at the heated part into a bulb, which can be readily lengthened or flattened by moving the headstock, C. The air is supplied by a bellows feeding a reservoir, which keeps an equal pressure, and the supply can be regulated, as we have said, at will.

In the same way two glass rods or tubes can be joined to each other by clamping the pieces in the two chucks, and bringing the free ends together while they are heated by the blowpipe. This operation is a tedious and expensive one when done by hand; and it requires great skill on the part of a blower to make even a clumsy joint between two long tubes. But with the new machine a neat joint can be made by an unskilled person in a very short time—a fact which will materially reduce the cost of many mechanical and philosophical glass instruments. Incandescence lamps, glass mercury pumps, and vacuum tubes, as well as such household articles of glass as candlesticks, and so on, can be made by Messrs. Wright and Mackie's apparatus with great facility after a little practice.

Engineering says that the machine has come into the hands of the Hammond Electrical Light Company, and a large factory is now being prepared for its construction and operation. The chief employment of the machine will doubtless be in the manufacture of electric incandescence lamps; but small machines of the same kind will also be useful to physicists and chemists.



WRIGHT AND MACKIE'S GLASS BLOWING MACHINE.

The Growth and Manufacture of Peppermint.

The cultivation of peppermint is an industry confined to a limited part of the country, and therefore but little is known of its variety and manufacture by most persons.

New Remedies recently gave a lengthy account of the cultivation and manufacture of peppermint, from which the following notes are made:

The account is descriptive of a visit to Wayne County, in New York State. It is now upward of fifty years, says the writer, since peppermint was first cultivated in that locality for its oil; the first attempt in America being made in Massachusetts. For many years it has also been grown in a few counties in Ohio, and in some parts of Upper Canada (Ontario). It growth in Michigan was first undertaken in 1855, and has since steadily increased. Western New York, however, produces the largest quantity of oil, and it is said that the products of that region are characterized by a finer aroma than that produced in most other localities in America. Of late, growers and refiners have devoted special attention to the selection of the best varieties of the plant, and to the qualities of the product. In Wayne County alone more than 3,000 acres of mint are cultivated annually, with an average yield of about 20 pounds of oil to the acre, or a total yearly production of over 60,000 pounds.

It is estimated that the annual production of oil of peppermint throughout the world is about 90,000 pounds, which would show that by far the largest portion—certainly two-thirds—comes from the Wayne County, New York, region. The peppermint harvest commences in America early in August, or as soon as the plant is in flower (by which time it will have attained a height of about 2 feet or upward), and continues into September, warm or hot weather being essential at harvest time, that the plant may produce oil abundantly. The first crop is the best, the second year's of less value, and the third year the ground may be again plowed, and the crop allowed to spring up from the broken roots. The yield in the third year, when the ground is treated in this manner, is somewhat less than that of the first year. After this the land should be devoted for a time to some other crop. Not only is the yield most abundant in the first year, but the crop is more free from weeds than during the subsequent years, and the oil is correspondingly purer. The weed which causes most trouble is the broom-weed, mare's tail, or fire weed (Erecthites hieracifolia), a composite yielding a volatile oil which is bitter and pungent, and by its presence impairs the naturally fresh, penetrating, and delicious taste of the pure oil of peppermint.

The mint is cut with a sickle, scythe, or mowing machine, according to the fancy of the cultivator. After cutting it is allowed to wither in the sun for five or six hours, and is then raked into "cocks," where it remains a short time before being distilled. This process is found to give a larger yield of oil, and to improve the odor of the product. It is not every cultivator that is provided with a still, but stills are found distributed about the peppermint region at convenient distances. Some are of the most primitive character, while others are constructed more elaborately. The apparatus and method differ from that employed in Europe, where the fire is applied to the still. In America the still consists of a wooden tub or vat of heavy staves hooped with iron. The withered mint is packed into the vat by treading with the feet until the vat is full, when a cover, made steam tight with rubber packing, is fastened down with screw clamps. A steam pipe connects the lower part of the vat with a steam boiler, and another pipe from the center of the cover connects the vat with the condensing worm. The latter varies in size according to the capacity of the still, but becomes progressively smaller toward the outlet. The worm is so placed as to have a constant stream of cold running water surrounding it. The steam from the boiler being admitted to the vat at a pressure of 30 to 40 pounds, the oil of the mint is volatilized and mixed with the steam condensed in the worm. The mixed oil and water are collected in the receiver, where the difference in their specific gravity causes them to separate. No attempt is made to redistill the water which separates, and a considerable loss of oil which is held in solution doubtless results from this lack of economy.

The oil is packed in tin cans, or glass demijohns, holding about 20 pounds each. The glass demijohns are much the best when the oil is to be kept for any length of time, as its good qualities are more fully retained, and it is less liable to discoloration. From the oil thus produced the refiners and exporters make their selections, and upon their judgment in selecting, skill in refining, and their honesty, as well as the care used in excluding foreign plants from the crop, depend the quality of the oil found in the market. It is very probable that most of the adulteration which this oil undergoes takes place after it has left the hands of the original refiners and dealers. At the present time Wayne County, New York, grows, refines, and exports the greater quantity of all the oil of peppermint grown in the United States and Canada.

Oil of peppermint is sometimes adulterated with turpentine, and also with oil of hemlock. Pure oil of peppermint, as exported from Wayne County, is colorless, and resembles the English oil, except that its odor and taste are somewhat less pungent and penetrating. The oil deteriorates with age, and the aroma becomes more faint; after a certain number of years it thickens, and the color becomes of a yellowish tinge; exposed for a long time to air, it becomes resinous.

To Restore Color.

When color on a fabric has been accidentally or otherwise destroyed by acid, ammonia is applied to neutralize the same, after which an application of chloroform will, in almost all cases, restore the original color. The application of ammonia is common, but that of chloroform is but little known.

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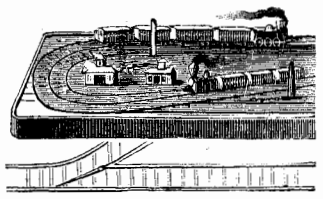
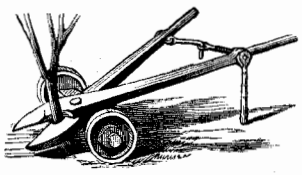
Toy Railway.

A toy railway which affords great amusement to children and adults is shown in the engraving. The board is divided into tracks and depot spaces of different colors by strips, and provided with switches. On these tracks, sliding locomotives and cars are moved from one station space to the other, and on the cars different colored blocks are placed, which represent freight or passengers. The board has its corners rounded and provided with a rim of rattan strips. By means of strips of rattan, tracks are formed on the surfaces of the board, and between the tracks sliding locomotives, flat cars, and box cars can be moved. If desired, the locomotives and cars can be provided with wheels. Switches are provided to switch the cars from one track to another, as may be desired. Strips also surround spaces on the boards which are called "depots," and have each a different color. Colored spots between the tracks at the depots indicate where the trains must stop for each depot. By means of the differently colored cars the child will be enabled to make a great variety of combinations. The device forms a game which will prove useful in kindergartens to illustrate how cars are switched, and how trains are made up. This invention has been patented by Mr. J. D. F. Meier, 140 Fifth Street, Oshkosh, Wis.



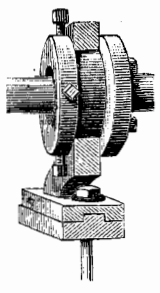
Improved Grubbing Shears.

The engraving shows a device for clearing land of underbrush, briers, weeds, etc., consisting of a heavy pair of shears mounted on a low strong truck, the shears being so formed that the underbrush, briers, weeds, etc., may either be cut off by them or grasped and uprooted, the handle ends of the shears serving as levers for this purpose. The handle ends of the shears are provided with a screw and lever, which may readily be brought into action for drawing them forcibly together for cutting off heavy brush and stalks that cannot be cut off by hand power alone. This useful invention has been patented by Mr. Peter Durham, of 148 Willoughby Street, Brooklyn, N. Y.



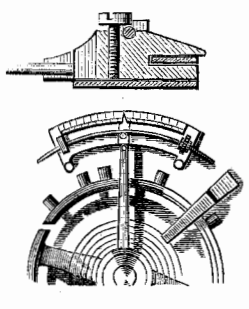
Centering Rest for Lathes.

This is a chuck or rest adapted to be attached to any lathe for holding and centering the work by means of set screws. The rest may be adjusted laterally for turning the piece of work tapering. A collar cast with the bed piece or plate forms a bearing for a sleeve, which is held in the collar by means of an annular plate and screw bolts. In the flange of the sleeve are placed four radial set screws for holding and centering the work. If the work is plain straight work, the piece is simply passed through the sleeve and centered by testing and turning the set screws one way or the other, as required, which at the same time firmly secures the piece between the screws. If the work is to be tapered, the collar is to be moved laterally one way or the other upon the base plate, and secured thereon in the proper position by the clamping screw, which passes up through the slot of the plate, and through the base of the collar. This useful invention has been patented by Mr. Augustus B. Wadsworth, of Contoocook, N. H.



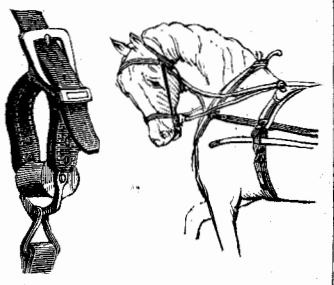
Improved Watch Regulator.

We give an engraving of an improved watch regulator recently patented by Mr. Charles M. Hoffman, of White River Junction, Vt. This regulator provides for a rapid general and special finishing adjustment of the watch, which may readily be brought down to close time, and the regulator restrained from being accidentally moved. The regulator engages with the hair spring in the usual way, and its free end is provided with a block that is slotted and slides upon a curved scale. The block carries a screw capable of clamping a curved rod which passes through a groove in the block and under the head of a screw, as shown in the enlarged sectional view. The ends of this rod are guided and supported in ears projecting from the base plate upon which the scale is mounted. One of the ears is double, and embraces a nut placed on one end of the curved rod. The watch can be approximately regulated by loosening the screw in the block, and moving the regulator in the usual way; then for fine adjustment the screw may be tightened and the regulator moved by turning the nut on the threaded end of the curved rod, which will move the rod, and block and move the regulator as slightly as may be desirable.



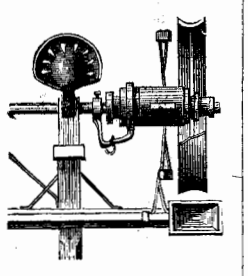
New Shaft Loop.

We give an engraving of a new shaft loop recently patented by Mr. Julius Wagner, 276 South Ninth Street, Reading, Pa. A horizontal anti-friction roller is journaled in a U-shaped frame, which has the upper ends of its shanks attached to the lower ends of a U-shaped leather loop, which is suspended by means of a strap from the harness saddle in the usual manner. The lower end of the U-shaped frame is connected by a strap, and a loop pivoted to the bottom of the U-shaped frame with the belly band. A shaft passing through the shaft loop will rest on the roller, and undue friction of the shaft on the shaft loop will be avoided. The shaft loops of a harness are generally rocked forward and backward by the movement of the thills or shafts in the loops, chafing and blistering the sides of the horse. This rocking movement is avoided by the roller. The roller can be made cylindrical or concave, and can be made of hard or soft rubber, or other suitable material which can be covered with leather, rubber, and cloth. It is preferably made of soft rubber, so that when the shafts rock up and down the shock produced will be taken up by the rubber roller and will not injure the animal. This is of great importance, especially in two-wheeled carts, where the vertical rocking motion of the shafts is quite considerable, and if continued any length of time would have an injurious effect on the animal. Many valuable horses have been crippled so as to be almost useless by the old shaft arrangement, but the improved loop prevents all these difficulties. It saves the shafts and harness, and is a decided improvement for the comfort of the horse.



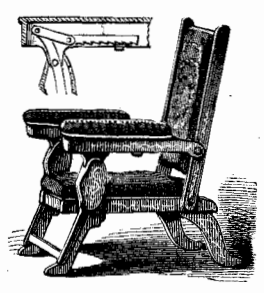
Improved Corn Planter.

The engraving shows an improved self-dropping and marking apparatus, the essential features of which are a drum mounted on the axle and carrying cams to work the dropper-slides, and markers to check-mark the rows, the drum being connected with one of the truck wheels by a clutch that serves to disconnect it readily, to stop the operations of the dropper-slide and the markers at the sides of the field and elsewhere when it is desirable not to have them work. By the location of the markers midway between the cams, and by the dropper-slide being on a line with the axle, a marker will be pressed on the ground by the side of the last hill dropped simultaneously with the shifting of the dropper-slides for dropping another hill, the markers being contrived so that they cannot fail to mark the rows correctly as dropped. At starting from the side of the field, care must be taken to so connect the drum with the wheel by the clutch that the dropping will be in line with the check-marks previously made, after which the apparatus cannot fail to drop in line. This invention was recently patented by Mr. Randolph O. Robinson, of Glidden, Iowa.



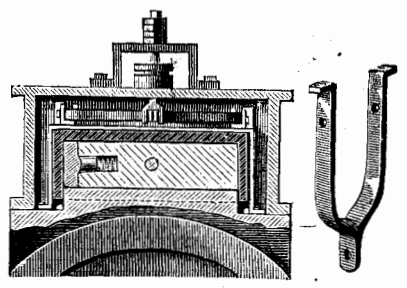
Reclining Chair.

The engraving represents an improved reclining chair recently patented by Mr. De Witt C. Sivey, of Greenfield, Ind. The seat frame of the chair is supported in the usual way, and the back of the chair is pivoted to the side pieces of the seat frame. The arms of the chair are pivoted at their rear ends to the side bars of the back, and at their forward ends the arms are pivoted to levers attached to the sides of the chair frame, and short hollow posts or shells inclose the levers. The levers and shells are pivoted to the seat frame. The arms of the chair are composed of the upper channel pieces, and the bottom plates secured to the under side of the channel pieces, thus making the arms hollow, as shown in the smaller view. The plates attached to the arms are slotted, and are formed with a downwardly projecting ear for pivoting the arms to the levers and the shells. Ratchet bars move in the hollow arms, as shown, and are connected by the connecting links to the upper ends of the levers. These levers may be made short, extending only a little below the pivots, if desired; but by preference they are made of considerable length, to extend near to the floor, and are provided at or near their lower ends with the foot piece, which will be raised up automatically when the back is reclined and lowered. In reclining the back of the chair it is only necessary to raise the lifters, which engage the ratchets, when the weight of the back will cause it to fall backward as far as it will go, or until the hands are removed from the lifters To raise the back from a reclined to an upright position, it is only necessary to raise or draw the back forward. Further information in regard to this invention may be obtained by addressing Messrs. Sivey & Snow, P. O. Box 434, Greenfield, Ind.



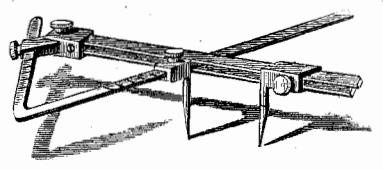
Balanced Steam Valve.

A balanced steam valve that works with but slight friction and wear, and also provides for convenient adjustment of the parts, is shown in the engraving. The invention consists essentially in a covering plate combined with the valve of the steam chest and connected to an adjustable yoke. The cylinder, valve chest, and the valve are of ordinary form. The cap or covering of the valve is formed with side flanges, of a width to cover the side of the valve, but is left open at the ends, so that the steam has free access to the space beneath the plate and to the ends of the valve. Within the steam chest and secured upon the cylinder are posts placed at the corners of the plate, and in the upper ends of these posts are pivoted the ends of yokes, one of which is shown in detail, there being two of these yokes jointed together at their ends over the center of the plate. The yokes are also pivoted to studs on the plate, and at their inner ends are jointed to a screw rod which extends through the top or cover of the steam chest, and is fitted at its upper end with a nut for its adjustment. The yokes and the adjusting screw are used for adjusting the plate tightly to the top of the valve, by turning the screw up or down. Around the mid length of the plate there is a strap, which is connected to the cylinder, and prevents the plate from rising too far. The plate or cover takes the steam pressure off the upper side of the valve, so that the steam has access only to the ends of the valve, and the pressure upon these ends will be equal. For this reason there will be little friction and wear in the movement of the valve, and the plate, being readily adjustable, will compensate for wear. This invention has been patented by Mr. James O'Donnell, of San Francisco, Cal.



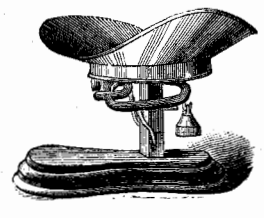
Instrument for Ascertaining the Draught of Moulding Cutters.

This instrument is for laying out the cutting edges of moulding cutters, so that they will cut a moulding of the desired pattern. The device consists in an angle bar provided with a slide, to which an arm is pivoted, the latter being provided with a slide having a pointer. The angle bar is also provided with a slide carrying a pointer, and by means of the two pointers the height of a member of the moulding is measured, and then the end of the arm and the end of the bar are separated until the angle bar rests against the slide of the arm. The distance between the pointers will then be the required draught of the cutter at the points corresponding to the certain member of the moulding. The slides are provided with binding screws to hold them in position after being adjusted. This instrument not only saves a great deal of time, but insures accuracy. It has been patented recently by Mr. Granville M. Drummond, 42 to 48 West 13th Street, New York city.



Scoop Balance Attachment for Weighing Scales.

This balance attachment is located under the platform and so arranged that a rod extending from the bottom of the scoop, through the platform, will be borne by the balance device, so that the scoop will be automatically counterbalanced without attention of the operator, and thus dispense with the application of the balance weight, in the use of which mistakes frequently occur through carelessness and forgetfulness of the operator. The scoop has a rod or stud, extending downward from the bottom through a hole in the platform of the scale, so as to rest on an arm of a lever pivoted in a yoke which is jointed to supports fixed to the scale standard and extends around the standard, where it carries a counter balance weight and over a pin on to which the yoke falls when the scoop is removed from the platform. The arm of the lever on which the stud of the scoop rests has a boss which bears against the under side of the platform, so that the lever will always preserve its horizontal position under the platform. The scale is used with this contrivance as is the ordinary balance beam scale, except that the usual provision for balancing the scoop is not made. The improvement avoids the necessity of applying a weight to the weight hanger for balancing the scoop. In the ordinary beam scale the lever is generally balanced for



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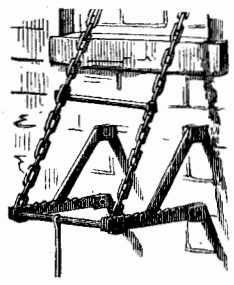
the platform, so that when it is desired to weigh anything in the scoop an additional balance is required for that, which may be forgotten, but which in this scale takes effect automatically. Mr. Asa Leas, of West Manchester, O., is the patentee of this invention.

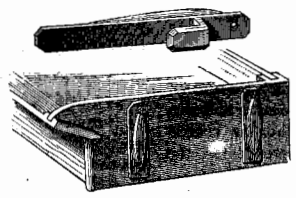
New Fire Escape.

In the wall of the building near the top is an opening of suitable size and form for receiving the improved fire escape; the opening may be an ordinary window, or a chamber may be arranged over the top of the wall and on the roof. In this opening or chamber a reel is supported by bearings attached to the wall, as shown, or to the roof, in any manner to support the reel, so that the chains of a fire escape ladder may be wound on and off the reel in and out of the window or other opening. The reel has a hand wheel, or a crank for turning it. The ladder consists of chains and metal step rods, the ends of the rods being passed through the links of the chains and secured by check nuts on opposite sides of the links. There are struts at the ground or a little above to project the ladder outward for inclining it, so as to make it easier to climb; also for drawing it taut, and to swing it clear of fire issuing from the windows. The struts are pivoted to the wall and braces are arranged in connection with them for applying tension to the ladder, the braces being pivoted to the wall and bearing at their lower ends on the notched sections of the struts. With a ladder of this kind the top of the highest buildings may be scaled readily by the firemen, and it also forms the means of escape as well. To enable persons to reach the ladder from lower windows, the tension of the ladder may be slackened temporarily. This invention has been patented by Mr. Othello Sutphen, 52 Orange Street, Albany, N. Y.



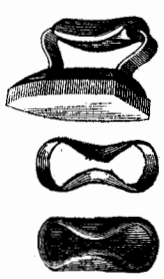
Wagon Box Stake.

A new stake for holding the upper or removable box of the wagon on the lower box is shown in the annexed engraving. The invention consists of a stake having on its inside a hooked projection, and re-enforced or braced on its outside. A flat bar of metal is secured to the outer surface of the side boards of the upper box, and extends downward. These bars are re-enforced by a longitudinal rib projecting from the outer surface, and made either integral with or separably, and secured to the stake. A hook projects from the inner surface of the stake for engagement with the edge of the box. This stake is to be used mainly on farm wagons on which an additional box is placed on the wagon box for the purpose of increasing the capacity of the latter. Such boxes have been held in place by the ordinary stakes, which are fastened to the upper box and pass through staples or loops on the lower box, or *vice versa*. This improved stake is much stronger and more durable than the ordinary stakes, and requires no staples to hold it in place, and removing and replacing the upper box is made easy. A box which is held by stakes passing into staples must be raised simultaneously at both ends; this is not necessary when this improved stake is used. This invention has been patented by Mr. Louis Rakow, of Elmhurst, Ill.



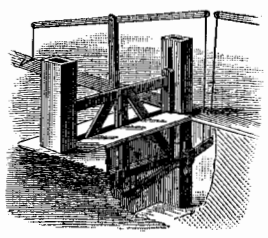
Sad Iron Holder.

The engraving shows a novel holder for sad irons, which will wholly protect the hand of the user from the heat of of the iron, and will cling to the handle and remain in place when the hand of the user is removed from the holder. The holder is composed of a clasp spring, outer covering, and padding placed in the covering and around the spring. The padding may be of cotton, wool, or of any other suitable non-conducting material, and should be of such quantity or thickness as to perfectly protect the hand of the user from the heat of the iron, and the outer covering may be of chamois skin or other leather, or of cloth, stitched around so as to inclose the padding and spring, leaving sufficient surplus material both in the covering and padding to surround the handle of the sad iron. Formed in this manner the holder may be easily placed upon and removed from the handle of the sad iron, and when in place on the handle it will be clasped and held there by the central portions of the spring, which reach under the handle, so that the user may remove her hand from the holder at pleasure without the annoyance and delay of having to replace the holder on the handle every time the hand is so removed, as is the case with the rag holders commonly used. This invention has been patented by Serena M. Carnes, of 103 East Sixteenth Street, New York city.



Automatic Gate.

This gate is arranged to slide up and down in grooved posts, and opens by descending into a pit below the sills placed at the level of the roadway, the gate being suspended by balance cords and weights on the pulleys in the post, so that it may be operated easily. This arrangement is also desirable for avoiding the obstructions occasioned by heavy falls of snow, and common to ordinary gates, because by arranging the bottom rail to fit snugly between the sills the snow will be prevented from falling through and filling the pit, and the gate will readily cut its way down through the snow when opened. To operate the gate a lever is connected with it in the pit below the roadway and pivoted to one of the posts, from which rods extend up through the surface to other levers, which extend each way to and are connected with road cranks for working the gate by the wheels of the carriage. The gate may, if desirable, be worked by hand. This invention has been patented by Mr. Franklin C. Wheeler, of 426 Felix Street, St. Joseph, Mo.



NATURAL HISTORY NOTES.

Rediscovery of Rhus Cotinoides.—This tree, since its discovery by Nuttall, in 1819, in Arkansas, and twenty-three years later by Prof. Buckley in north Alabama, has not been found by any other botanist, and our knowledge of it has remained obscure. After having been lost to the botanical world for fully forty years, it has recently been rediscovered by Mr. Chas. Mohr, who gives an account of it in the *Proceedings* of the Philadelphia Academy of Natural Sciences (part ii., p. 217).

Mr. Mohr found the tree growing scattered along one of the rocky ravines that traverse the terrace-like shelves of limestone on the southern declivity of the Cumberland Mountains, as they descend upon the valley of the Tennessee River, in Madison County, Ala. The specimens found here ranged from 25 to 35 feet in height. The largest one felled had a trunk 35 feet in length and 12 inches in diameter at one foot above the ground.

"Arrived at such dimensions," says Mr. Mohr, "the tree has evidently long passed the best period of its life, judging from the decay by which, more or less, the trunk was found affected. No sign of a decline, however, could be observed in the vigor of its vegetation. The trunk divides at a height of from 12 to 14 feet above its base; the primary limbs are erect, the secondary branches widely spreading, often slightly reclining, smooth, and divide into numerous divaricate reddish branchlets, rugose from the base of the leaf-stalks of the previous season. The bark is rough, covered with a whitish-gray epidermis of a deep chestnut-brown underneath, and exfoliating in oblong square scales of uniform size. The inner bark is white, exposed to the air, turning rapidly to a deep yellow, and exuding, when bruised, a resinous sap of a heavy, disagreeable, terebinthinous odor. The wood is heavy, very compact, of a fine grain; the white sap wood of small proportion surrounds, as a narrow ring, the deep yellow hard wood, variegated by zones of different shades of brown, imparting to it a beautiful appearance when polished.

"The inner bark and wood are used for dyeing yellow, and, it is said, also for the production of purple tints. On this point, however, no definite information could be obtained.

"Large numbers of the trees were cut down during the war to procure a dyestuff much valued at the time, and full-grown ones are now quite scarce near the settlements. . . . The wood permits of the highest finish; the fineness of its grain, beauty of color, and its hardness fit it well for inlaid work, veneering, and the manufacture of smaller articles of all kinds of fancy woodwork.

"As an ornamental tree it far surpasses the European *Rhus cotinus*, and will be found quite as hardy."

Heliotropism in Sunflowers.—At a recent meeting of the Philadelphia Academy of Natural Sciences, Mr. Thomas Meehan exhibited flowers of *Helianthus mollis*, and remarked upon the popular fallacy of sunflowers turning with the sun. The original "sunflower," connected with the Ovidian stories of Clytie and Phœbus, was the European heliotrope, and even that did not turn with the sun in the modern popular sense. It simply grew where the sun loved to shine, and the plant did not flower till the sun had reached its summer solstice. The tragical part of the mythological story is founded on the fact that the plant continued to open its flowers as the sun declined, or, as Ovid might say, its affection for its beloved was in proportion as the lover fled from her to his winter quarters. The *Helianthus* was named "sunflower" simply because its flowers resembled the sun; and there is no relation between it and the sunflower of mythology. Yet there are peculiarities worth noting. Travelers across the Western plains, where sunflowers abound, have often observed a large proportion of flowers facing one direction, but there were always some in other directions, and these exceptions seemed to prevent any generalization as to special points of the compass being favored more than others. Mr. Meehan had growing in his garden plants of *Helianthus mollis* from seeds gathered some years ago in Illinois, and the flowers always seemed to have, to a great extent, a general southern leaning; but, until this season, he had not thought to make exact figures early enough to be satisfactory. This season he found the first flowers open on the 7th of August. The upper part of the flower stalk was curved, so that, when the flower opened about a quarter of an inch of the stem was at right angles with the lower portion, and the face of the flower was exactly horizontal. It was subsequently found that the flower remained in this horizontal position till the last disk floret had expanded (occupying about three days), when the whole head commenced to occupy an erect position, taking about three days more to fully accomplish it. Commencing to open on the 7th of August, by the 11th there were 68 flowers expanded, all facing exactly southeast on opening; but on the evening of this day three were found which had changed around to northeast, with a slight tendency up from the horizon. On the 14th there were 73 flowers open, 21 of which faced northeast. On examining the matter carefully, the inclination to the north was found to be due to a slight spiral or uncoiling growth during the advance from the horizontal rest to the erect position. All do not do this, but uncurve rather than uncoil. While this accounted for the northward advance, often as much as 90 degrees in a number of flowers, it still left the reason for the original facing of the flower to the southeast among the many problems of plant life yet to be solved. Mr. Meehan referred to the several reasons offered in the explanation of polarity in the leaves of the compass plant, and pointed out the unsatisfactory character of all of them.

Dr. Henoque's Transfer Process on Glass.

Dr. Henoque has shown us his method of transferring outlines obtained by means of a stylus on blackened paper on glass. This mode of describing curves in apparatus for meteorology, physiology, etc., is frequently employed, only the outlines are generally executed on paper rolled on cylinders. To photograph these designs, or project them on a screen, it is usual to transfer them to glass without any alteration, the transparency of which renders it capable of being used in either way. Dr. Henoque, after removing the blackened sheet from the cylinder round which it has been rolled, spread it on a glass, and coated the smoked surface with castor oil collodion. As soon as the collodion is set, the plate is plunged into water, and, after a moment, a floating pellicle of collodion rises to the surface, bearing the film or smoke and the traced outline. It is next transferred to glass by means of a sheet of paper, and made to adhere with gum applied all over the plate. Great precaution must be taken to fix the four edges of the pellicle by strips of paper gummed. When dry it forms a perfect negative, or may be used as a transparency to project on a screen. In the same way, as Poitevin has indicated, chalk drawings may be removed from paper and transferred to glass. The paper for smoking, says Dr. Henoque, should be albuminized and lightly gummed. To smoke glasses on which lines are to be traced with a point, they may be coated with lamp black paint, and the blackened surface afterward passed over a petroleum lamp flame. The smoke covers over all the inequalities of the coat of paint, and the design may be immediately traced. It can also be taken off and transferred to another glass in the way already indicated.—*Photo. News.*

How a Nevada Miner is Following an Air Current as a Lead.

A tributor of Ruby Hill was asked how his "pitch" looked, and he made the following curious remark: "I am following a streak of wind." Strange as this may appear, yet it is true. It appears that in sinking upon his piece of ground he came upon a crack in the rock about three inches in width, from which issues considerable air. Where it comes from and what the miner may strike in following this strange "lead" must for the time remain a mystery. The miner was right in following his "streak of wind." He doubtless understands that this streak of air breathed out of the dep ths is liable to lead him to a cave, and he also knows that a cave is liable to contain an amount of ore that would make his fortune.

Among the old lead mines of Galena, Ill., a "streak of wind" or 'breathing crevice" was always considered a first-class indication. When a miner found that, he was pretty sure of finding a cave filled with lead ore. The lead mines of Galena are in a limestone formation that is much the same as the formation about Eureka.—*Ruby Hill News.*

THROUGH the energy of its president, Samuel Sloan, Esq., the New York Horticultural Society, at a cost of $100,000, has secured a building for its permanent home. During the past year this society has held monthly meetings, at which times there has usually been a display of flowers and a short essay read by some member of the association. Money prizes have been awarded for the best specimens of different classes of flowers, which has greatly stimulated a spirit of emulation among the gardeners and flower raisers.

GLASS varnish may be made of pulverized gum adragant, dissolved in the white of eggs well beaten. Apply with a brush carefully.

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ENGINEERING INVENTIONS.

A car coupling device of improved form has been patented by Mr. Nathan M. Hale, of Grand View, Tex. This invention relates to improvements in self-acting car couplings, and consists essentially of contrivances for setting the buffer or drawbar and a pin setting, tripping, and uncoupling device higher or lower for adapting the coupling to couple self-actingly with cars differing in height.

Mr. James H. McLeary, of San Antonio, Texas, has patented an improvement in car couplings. This coupling is automatic in its coupling operation and readily uncoupled at the side of the cars or upon the top, so that the operator is not required to go between the cars to couple or uncouple them. It consists in the employment of a handled shaft hung in suitable bearings or buffers at the end of the car, and having a wheel provided with a series of pins or arms adapted to be automatically projected and retracted, the shaft also having ratchets engaged by holding pawls.

MECHANICAL INVENTIONS.

An improvement in feed roller gear for wood planers has been patented by Mr. Paul Stoerger, of Chicago, Ill. The invention consists of a chain-belt contrivance to be used in substitution of the toothed gears now employed, by which is obtained economy of driving power, a wider range adjustment for the upper rollers, and other advantages.

Mr. William B. Farrar, of Greensborough, N. C., has patented a new turbine water wheel. The invention consists in certain changes in the construction and arrangement of portions of the wheel case, whereby the casting of the same and its repair in case of injury are greatly facilitated; and also in the pivots of the gates of the case and the lever for operating them.

An improved grain weigher and tally has been patented by Mr. Jesse Beeler, of Girard, Kan. This invention consists of a tilting hopper, a couple of weigh beams, a recording tally, and shifting apparatus contrived to automatically shift the hopper from one delivery spout to another each time the bag fills and swings up, the weigh beam from which it is suspended at the same time shifting the recording tally.

A separating and drying apparatus has been patented by Mr. Howard Newlin, of Brooklyn, N. Y. The invention consists in a novel construction of the screen or drier, which is formed with a series of inclines and shoulders extending transversely for insuring the forward movement of the substance in the frame or chute, and separating the different materials. This is also employed for drying and cooling grain.

A novel runner for casting steel ingots has been patented by Mr. Theodore G. Wolf, of Scranton, Pa The molten steel, instead of being passed into the mould directly in the ordinary way, is caused to flow through a runner, whereby the ingots have fewer air holes and will be more solid and the steel of a better quality, and the casting will be done in less time and with less waste of steel.

An improved fire grate designed to stir the fire and open up a space in its center to allow the discharge or escape of pieces of slat or clinkers has been patented by Mr. Edward F. Johnson, of Troy, Pa. The invention consists in the employment of curved radial arms pivoted to the grate, and having pins moving in oblique slots or apertures in the grate supporting frame, whereby the desired results are attained.

Mr. Theodore A. McDonald, of New Albany, Ind., has patented a novel gauge for rip saws. This invention relates to gauges used principally with small circular saws on a saw table where boards or planks are ripped up into strips of various sizes; and it consists of a lever and link contrivance for holding and moving the gauge bar, whereby the bar may be easily and quickly moved to its different postions and its parallelism with the saw always maintained.

An improved speed and motion regulator formachines has been patented by Mr. Christ Adler, of Milton Center, Ohio, the great advantage of which device is that the speed and the motion can be changed without stopping the machine, whereby a great loss of power is avoided, and the parts are not subjected to great or sudden strains. This invention can be applied to any machinery, but is best adapted for use with sawing machines.

Mr. Merritt W. Palmer, of Holland, Mich., has patented an improved planer knife grinder. The invention consists of an attachment to be temporarily applied to wood planing machines for grinding the cutters or knives on the machine as set for work, and without removing or disturbing them. The difficulty of resetting the cutters after being removed for grinding in the common way is thus wholly avoided and much better work secured.

An improved method of manufacturing wood stirrups has been patented by Messrs. James Woolworth and Wilber F. Cowles, of St. Mary's, Ohio. The invention consists of a slat bent into the desired shape and slitted in the direction of the grain of the wood, said slat being bent at its upper ends vertically where the roller and connecting crosspiece is connected thereto, whereby the stirrup is not weakened at the neck or bend, as is the case in the ordinary method of manufacture.

A novel process of facilitating the cutting of nails, tacks, etc., has been patented by Mr. Seth Robinson Foster, of St. John, New Brunswick. The invention relates to a process for preventing the scale on iron or steel plates used in the manufacture of nails, tacks, brads, and shoe nails from wearing into the knives, dies, and other tools of the machine while cutting, without removing the natural scale on the surface of the iron or steel, thereby avoiding the waste of metal, facilitating the cutting action, and avoiding the necessity for sharpening the knives so often.

A stock loading chute of novel device has been patented by Mr. Daniel E. Hogbin, of Ellinwood, Kan. It consists of a movable platform supported upon rollers and connected with the ground by an inclined platform or chute. The movable platform is so arranged that it may be projected through the door of the car as far as desired, so that the stock may be readily transferred to and from the inclined platform and the car, or when not in use the platform is drawn back out of the way, so as to clear the car. There is no liability of the movable platform becoming hindered in its operation by dirt or mud freezing beneath its bottom, as the supports beneath are left open so as to permit the dirt to fall.

Mr. Abram N. Ackerman, of Passaic, N. J., has patented an improved winding shell for calico, etc. The invention relates to the hollow wooden shells which are used for winding long strips of calico or similar material into large rolls; and it consists of a metal casting consisting of a central portion which has a square passage through it and a surrounding ring connected with the central portion by fins, the casting to be forced into the ends of the shell for strengthening it and for connecting the ordinary power shank by which the shell is revolved.

Messrs. Edward C. Shaw and George H. Flinn, of Lewiston, Me., have patented a clearer for lifting rods of spinning frames. In spinning cotton the floating fibers, termed the "flyings," collect upon the lifting rods, and as these rods move up and down in their bushings the flyings are carried into the bearings and frequently become wedged so tightly as to bind and stop the rods, thus preventing the movement of the ring rail and the proper winding of the yarn upon the bobbin. Their invention is to obviate this difficulty, for which purpose they provide lifting rods with clearers that prevent the flyings from passing into the bearings of the rods.

A device for the measuring of belting, bands, or pieces of fabric has been patented by Mr Thomas A. Bell, of Trenton, N. J. The process is substantially as follows: A large wheel of some suitable and definite dimensions, and divided into feet and inches, is journaled upon supporting bars, and connected with this is a registering wheel of small dimensions, which notes accurately every revolution or partial revolution of the measuring wheel. On opposite sides of the measuring wheel are placed two rollers, one of which holds the material to be measured, the other being the roller upon which the material is to be passed. In the process of passing the material from one roller to the other, the measuring wheel is set in motion, and by means of the registering wheel connected therewith, the amount of the material is readily ascertained.

AGRICULTURAL INVENTIONS.

A colter fastener of novel invention has been patented by Mr. Enoch C. Eaton, of Pinckneyville, Ill. It consists of an attaching device for connecting the colter to the plow beam, contrived so that it may be shifted so as to set the colter vertical upon any plow beam, no matter how untrue it may be, and thus avoid the tedious method of wedging, at present in use, or fitting the iron true to the beam.

An improved adjustable and detachable handle for plows, etc., has been patented by Mr. James M. Clark, of Lancaster, Pa. The invention consists in the employment of adjustable handles consisting each of a handle and an attaching and adjusting plate, the handles being pivot bolted to the handle beam, whereby it may be applied readily to any plow or other like implement, placed in any position and adjusted to any height required.

An invention relating to an improved cotton chopper, scraper, and cultivator combined in the same implement, has been patented by Mr. John P. Dever, of Batesville, Ark. It consists in the peculiar relations of parts whereby by abstracting certain screws and bolts the cultivator teeth may be removed, and the machine used simply as a chopper and scraper; and on the other hand, by removing the gear holding the chopper and scraper to the vehicle, it may be readily converted into a cultivator.

MISCELLANEOUS INVENTIONS.

A new and improved millstone dress has been patented by Mr. Fredrick W. Dove, of Jonesborough, Tenn. The invention consists of a novel form of the furrows adapted to cause a free passage of the grain between and of the chop from between the stones.

Mr. Antonio di Mariano, of New York city, has invented an ornamental bracelet. The object of the invention is to provide bracelets constructed in such a manner as to serve as a receptacle for a glove button hook, pencil, or other implement.

An improvement in breech-loading fire arms has been patented by Mr. Alexandre Picard, of Montaigu, France. This invention consists in certain improvents upon the fire arm patented to the same inventor, February 7, 1882.

A novel paper scoring machine has been patented by Mr. Albert E. Elmer, of Springfield, Mass. The invention relates to a machine for forming the "scores" or "breaks" in sheets of straw board or other paper preparatory to bending the sheets for forming paper boxes for other purposes.

An improved pitcher has been patented by Mr. George Gough, of New York city. The invention consists of a pitcher constructed with two spouts, and so pivoted on its stand that it is adapted by means of the handle or bail of the stand to be tilted in either direction; also of a novel means of locking the cover in place upon the pitcher.

Mr. Joseph Imler, of Forest, Ohio, has patented a device which provides means whereby the point or section of the tube to which the strainer of a pump is attached may be introduced into the well after the tubing is inserted, and also to provide improved valves and seats, which can be removed without removing the tubing.

Mr. Herbert Ludlow, of Brooklyn, N. Y., has patented an improved folding box. The special advantage of the invention is that the waste of material is very slight, that the box may be easily set up for use, and that the cover may be made of one piece of material, so that anynumber of them may be placed one inside the other for economy of space in packing.

An improved apparatus relating to the separation of gold and silver from gravel and sand has been patented by Mr. John T. Long, of Monsey, N. Y. It consists in a series of amalgamated trays fitted for vibration and arranged one above the other, and so inclined that the material is passed in succession from a higher to a lower tray and the different materials readily separated.

Mr. Alexander D. Bertier, of Hannibal, Mo., has patented an improved wagon brake. The invention consists of ratchets applied to the hubs of the wheels, and a latch to fall into them to automatically chock the wheels and hold the wagon from running backward when the horses stop for rest on steep hills, and thus avoid the labor of applying and releasing the brakes by the driver.

Mr. Charles H. Gilbert, or Andover, Mass., has patented an improved swinging adjustable bracket for holding dentists' instruments and for other purposes. The invention consists in a pivoted sleeve carrying two parallel arms which support the table. The arms are sustained at any desired elevation by an ingenious ratchet arrangement.

A patent has been obtained for an improved hopple for animals, whereby the ordinary end links for connecting the chain with the leg bands shall be dispensed with, and greater ease and freedom of movement between the said parts shall be secured. The inventor of this useful device is Mr. Charles J. Gustaveson, of Salt Lake City, Utah.

Mr. Joseph Herzog, of New York city, has patented a novel slide for chain bracelets and other chains. The invention consists in a slide for ladies' chain bracelets and other chains, constructed with a base plate having flanges upon its ends and one side, and provided with a catch whereby the slide can be readily adjusted upon its chain without friction and wear.

Mr. Henry R. Wright, of Albany, N. Y., has obtained a patent for the manufacture of an artificial butter called creamine. The process consists in mixing together the oils derived from animal fat at low temperatures with sweet cream, the oil of butter, vegetable oil, and coloring matter, then allowing these ingredients to become sour while together, then removing the whey, and finally churning the mass.

Messrs. Alonzo Russell and Andrew J. Russell, of Burr Oak, Mich., have patented an improvement in that class of fences that occupy a comparatively small space in width, that are set up without the necessity of digging holes, and that are firm both longitudinally and transversely. The fence consists of posts, side stakes, longitudinal rails, and braces, all wired together.

Mr. Isaac Samuels, of Denver, Col., has patented an improved watch pocket. The invention consists of a pocket of chamois skin or other approved material, within which is arranged a wire spring of semicircular or semielliptical shape, which stretches the pocket flatwise, closing the mouth. The ends of the spring terminate in points which serve as pins by which the pocket may be attached to the garment.

An amalgamator, the object of which is to facilitate obtaining the gold contained in the sand of the beach and the bottom of the sea, has been patented by Mr. William H. Leininger, of Salem, Oregon. The invention consists in a device to which a series of amalgamated plates are attached, which device is drawn through the auriferous sand, which is thereby stirred and raised, so that it passes between these plates, the gold being retained on these plates.

Mr. Isaac Van Zandt Jones, of Salado, Tex., has patented a useful improvement in churn powers. The invention consists principally in providing means whereby a churn may be attached to a sewing machine, so that both sewing and churning may be done at the same time; also, of the combination of a power to be operated by hand or some other motor, for running the sewing machine and churn both at the same time or either alone, as desired.

Mr. Samuel N. Silver, of Auburn, Me., has patented an improved velocipede. The object of the invention is to provide a velocipede which can be propelled easily, and in which the power of the impetus of the machine in going down hill can be stored and utilized at the proper time, and also in so arranging belts over the shoulders of the operator, that extra weight may be brought to bear upon the treadles of the machine.

Mr. John G. Schill, of Hoboken, N. J., has patented an improved trap for preventing sewer gases from escaping from the waste pipe of a sink into the room. The invention consists of a funnel projecting from the bottom of the sink, a casing provided at its inner surface with recesses, and attached to the sink bottom, and a cup provided with lugs fitting in the recesses of the casing, and surrounding the lower end of the funnel attached to the sink.

An improvement in the manufacture of dextrine, glucose, and grape sugar has been patented by Mr. Charles Lauga, of New Orleans, La., assignor to himself and Alexander Charles Landry, of same place. This process of manufacturing glucose and grape sugar consists in attacking the cereal or starchy matter with a weak oxygenated glucose liquor mixed with phosphoric acid, then neutralizing the product with one of the saccharates of the alkaline earths, and then filtering, decolorizing, and concentrating it.

An improved heel for boots and shoes has been patented by Mr. Charles Dranly, of La Salle, Tex. The object of this invention is to furnish substantial and durable heels for boots and shoes, and costing but little in comparison with leather heels. The heel has a metallic shell provided with a bottom rim, turned inwardly, an inwardly turned lip at the upper edge, and a vertical projection, whereby the filling is securely held, and the shell attached to the shank, as well as between the sole and upper.

An invention to facilitate the folding of benches, tables, and settees has been patented by Mr. Robert B. W. Pinckney, of New York city. The invention consists in a bench or settee constructed with grooved top and side boards and hinged legs, and with rods placed loosely in said grooves, so as to drop by their own weight against the legs and lock them in place, and to drop back by their own weight into the said grooves when the bench, table, or settee is inverted, and thus leave the said legs free to be folded.

Messrs. Jeuleos Gambllee and John F. Haring, of Cresskil, N. J., have obtained a patent for an invention which is designed to increase the durability of vehicle axles and to facilitate their repair. It consists in an axle constructed with an adjustable bushing secured in place by a tubular nut, and provided with grooves and passages to receive oil, and an adjustable band provided with set screws and oil hole, whereby the bushing can be adjusted as each side becomes worn, and can be readily supplied with oil.

An improvement in coffee roasters has been patented by Mr. William W. Dunn, of Fort Worth, Tex. The object of this invention is to provide an improved apparatus by which green coffee may be evenly, quickly, and economically parched or roasted to the required degree without burning, thereby producing an article of superior flavor. The heating chamber or oven for roasting green coffee, etc., is formed of a casing, a series of vertical flues traversing the same, and horizontal wire screens for retarding the velocity of the falling coffee kernels.

An improved torpedo placer has been patented by Martin D. Williams, of Long Island City, N. Y. The object of this invention is to facilitate the work of placing torpedoes upon the rails of railroad tracks. It consists in a torpedo carrier fitted for operation from a distance to place the torpedo when required, and to remove the same when the necessity for its use has passed. In practical operation the train that explodes the torpedo will stop, and the train hands replace another, so that there will be no necessity of sending from the station for that purpose.

An improved music box which can be adjusted to play any desired piece of music by persons who are not acquainted with the art of performing on musical instruments, has been patented by Mr. Miguel Boom, of Port-au-Prince, Hayti. This music box is constructed with a rotary disk and a radial stationary musical comb, a disk having radial parallel-sided grooves in its face, and teeth arranged to fit anywhere in the grooves, so that revolving the disk will bring said teeth against the teeth of the musical comb, and the same teeth may be set to play different tunes.

Mr. Andrew Harbison, of New Castle, Pa., has patented an improvement in wire tubing. This tube is composed of an inner coil or tube formed of spirally arranged wires, in juxtaposition or in contact with each other, surrounding and in contact and concentric with which is arranged an outer coil or tube formed of wires coiled spirally in a direction opposite to that of the inner coil or tube, with intervening spaces between the wires of the outer coil, the outer and inner coils or tubes thus joined together, and the wires of the outer and inner coils being soldered together, thus forming a single strong and flexible wire tube.

An improved apparatus for desulphurizing gold and silver ores has been patented by Mr. William E. Harris, of New York city. The apparatus consists in the combination of an ore grinding apparatus having above it an inclosed air tight case, air inlet pipes adapted to be connected with an air forcing apparatus, and a fire chamber under said grinder with a pipe connecting said case with the upper part of a desulphurizing furnace, the furnace being constructed so that the blast carrying the pulverized ore enters above the grate and passes down through it, the whole operating to dry the ore as it is ground and then blow it through the desulphurizer.

Mr. Alexander Fraley, of Grayson, Ky., has patented an improved beehive, the object of which is to promote convenience in taking care of, wintering, and feeding bees. The hive is constructed in such a way as to form at will either one, two, or three compartments, and thus may be used for wintering as many as three distinct colonies of bees. A sliding feeding trough is likewise attached, which by means of perforations in the bottom supplies liquid food to the various compartments, or when filled with dry food is furnished with openings by means of which the bees from each section may gain access to the food supply.

An improved photographic shield has been patented by Mr. Erastus B. Barker, of New York city. The invention consists in a photographic shield constructed with a removable plate septum that is adapted to be inserted within the shield either side up, whereby either horizontal or vertical pictures can be taken by simply changing the position of the septum, also in a removable cover for excluding light and holding the septum in the shield. This is provided with locking devices and springs for holding the septum in the shield and throwing the cover open automatically when the same is unfastened, and also in a self-acting spring attached to the septum for the purpose of automatically locking and holding the sensitive plates in the septum.

Mr. Hughey Thompson Harris, of Phil, Ky., has patented an improvement in fences. This invention relates more especially to "flood fences," and is designed to effectively resist the action of currents of water, and thus prevent the washing away of the fence in the event of the inundation or flooding of the land or country. It consists in the employment of triangular braces and pickets or boards, both anchored by being planted in the ground and tamped, a rail or support for the upper end of the pickets or boards to rest against, said rail or support being fastened to the upper part of the braces, and the lower ends of the coincident pickets resting on the underground base pieces of the braces, while across the base pieces is placed a board embedded with them in the ground and brush.

Mr. Coulder C. Dedermick, of Howard City, Mich., has patented an expansible wedge for opening saw kerfs for preventing a log, while being sawed, from binding or pinching the saw passing through. It consists in two jaws, having each its lower end thicker than its upper end, which jaws are connected loosely together at the top, and are combined with a central stem or follower, which, by passing down between the jaws, spreads the latter and causes them to expand the saw kerf, the said semi-cylindrical jaws having their inner edges straight to the end, so as to form an outlet for the saw as it progresses in its cutting action, and being designed to be seated in a hole, which is first bored where the cut is to be made.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Blake's Belt Studs. The strongest and best fastening for leather or rubber belts. Greene, Tweed & Co., N. Y.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 29.

Contracts taken to Manuf. small goods in sheet or cast brass, steel, or iron. Estimates given on receipt of model. H. C. Goodrich, 66 to 72 Ogden Place, Chicago.

To Inventors.—We have surplus power and machinery, and will contract to manufacture patented articles of wood. Howe, McClure & Co., Erie, Pa.

Wanted.—A second-hand dead-stroke power hammer. Address, with description and price, Box 150, Millersburg, Pa.

American Fruit Drier. Free Pamphlet. See ad., p. 29.

Am. Twist Drill Co., Meredith, N. H., make Pat. Chuck Jaws, Emery Wheels, Grinders, automatic Knife Grinders

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Brass & Copper in sheets, wire & blanks. See ad. p. 29.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Cotton Belting and Rubber Belting; two, three, and four ply; all widths. Greene, Tweed & Co., New York.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 29.

Otis Passenger Engine & Safety Drum, Cylinders 8x10, Double Cut Gears, in good condition. L. S. Graves & Son, Rochester, N. Y.

Metallic letters and figures to put on foundry patterns; all sizes. H. W. Knight, Seneca Falls, N. Y.

Pays well on small investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday-schools, and home amusement. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

See New American File Co.'s Advertisement, p. 30.

Drop Hammers. Power Shears, Punching Presses, Die Sinkers. The Pratt & Whitney Co., Hartford, Conn.

Steam Pumps. See adv. Smith, Vaile & Co., p. 29.

Trevor's Patent Key Seat Cutter. Trevor & Co., Lockport, N. Y. See page 29.

Stone bottles for beer and ink. Merrill & Co., Akron, O.

25" Lathes of the best design. G. A. Ohl & Co., East Newark, N. J.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 414.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

4 to 40 H. P. Steam Engines. See adv. p. 412.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

Engines, 10 to 50 horse power, complete, with governor. $250 to $550. Satisfaction guaranteed. More than seven hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Brass Finishers' Turret Lathes, 13½ x 4, $165. Lodge, Barker & Co., 189 Pearl St., Cincinnati, O.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven, Conn.

To stop leaks in Boiler Tubes use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 80 to 88 Market St., Chicago, Ill.

Water purified for all purposes, from household supplies to those of largest cities, by the improved filters manufactured by the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Assays and Analyses of ores and all commercial products. Advice given and investigations made in all branches of chemical industry. Send for circular. N. Y. Assay Laboratory, 40 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description.

Combination Roll and Rubber Co., 68 Warren street, N. Y. Wringer Rolls and Moulded Goods Specialties.

First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street. P. O. Box 3083, New York city.

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Cope & Maxwell M'f'g Co.'s Pump adv., page 12.

Curtis Regulator, Float, and Expansion Trap. See p. 12.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 14.

The Sweetland Chuck. See illus. adv., p. 14.

Knives for Woodworking Machinery, Bookbinders, and Paper Mills. Taylor, Stiles & Co., Riegelsville, N. J.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) S. S. D. writes: 1. I wish to make a magnet and have the core 2 inches long, 1½ inches wide and three-sixteenths or one-quarter inch thick. How many layers of wire, and of what size should I use to get the best result in strength from three Grove cells of one gallon each, and should the wire be silk or cotton covered? A. Wind with six layers of No. 16 cotton covered wire. 2. How many ounces or pounds weight (iron) would the magnet attract, and how far would it move said weight to draw it to the magnet, which would be stationary? A. The power of a magnet is inversely as the square of the distance. The magnet would probably lift fifty pounds. By making the cores thicker and longer, you would be able to get more power with the same battery. 3. Will I get more strength from the magnet by using more cells? A. Yes. 4. Have you ever published directions for making an electro-motor in any of your publications? If so, when? A. See SUPPLEMENT, No. 259. 5. Should I use soft or hard iron in making an armature? A. Use the softest iron obtainable.

(2) J. D. asks: 1. Is there any difference in the buoyancy of an iron vessel or boiler upon the water, whether it be full of air or whether the air be pumped out, and providing the vessel will resist the air pressure without collapsing? If so, what is it? A. There is a difference; *i. e.*, that of the weight of the air exhausted. 2. Would the same dam that would be capable of resisting the pressure of water in a stagnant pool, 100 yards long to the height of 10 feet, be capable of resisting the pressure of a similar pool were it three or five miles long; in other words, would the pressure be any greater in latter case? In both cases the water to be perfectly stagnant. A. The pressure would be the same in both cases. 3. Where does ice form, on the top of the water or in the bottom of the stream? A. Both. In still water on the top. In swiftly running water sometimes on the bottom. 4. Will a brake shoe have any more resisting purchase on the wheel of a common road wagon, carriage, or railroad car wheel if placed below a direct horizontal line with the hub or spindle than if placed above? A. No.

(3) J. H S. asks: 1. Will you furnish me with a receipt for making hair oil and cosmetics? A. Hair oil is generally made of pure cotton seed oil, perfumed with oil of bergamot, lavender or other perfume. See SUPPLEMENT, No. 65, "Perfumery Receipts." 2. Inform me how or where I can learn the making of essential extracts, as used in pastry and confectionery? A. See SUPPLEMENT, No. 196.

(4) A. C. asks: Is black a color? A. Yes.

(5) P. McC. writes: 1. With what and how can I color whitewash a bright red, a dark red, a green, a sky blue, and a drab? A. Use the following: For reds, a fine red lake; green, use a chrome green; blue, use ultramarine; and for drab, a lake of the desired tint. 2. Also, how much white lead and boiled oil will make a gallon of paint for last coat? A. Two pounds of lead to a gallon of oil.

(6) S. P. C. writes: Please give a simple and effective method for marking or labeling small specimens of quartz. A. Use a paraffine crayon, such as is used for marking packages, or melt with one ounce of paraffine sufficient lamp black, or other pigment to color, and run into cylinders of convenient size.

(7) W. S. B. writes: With two streams of water, one 2 inches in diameter, and one 1¼ inches in diameter, which will be thrown higher vertically with the pressure of a head of water 100 feet high? A. The 2 inch stream, as it will not break so soon from the friction of the atmosphere.

(8) D. O.—To remove printer's ink from paper use a solution of "chlorinated soda," which is called Larabeque's Solution by some druggists. Use as directed on label.

(9) I. C. writes: Suppose Mr. Brown is hammering with a steel hammer on a steel anvil, and at the time he is hammering there are no ears in existence, *would there be any sound?* A. The meaning of *sound* is twofold. It implies (in this connection): 1. Atmospheric or other vibrations capable of being heard. 2. Sensation, which may or not be caused by vibrations external to the ear. In the case described there would be sound of the first sort only.

(10) K. W. P. asks: Can you give me a formula for a composition of the consistency of putty or dough, that can be pressed (not moulded) into shape of small ornaments? A. Try plaster of Paris mixed with ten per cent of powdered althea root.

(11) L. L. D. asks: 1. In cutting a file, does the file cutter begin at the shank or the point; and what is the shape of the chisel point, and how is it held with regard to the file blank? A. In cutting files begin at the point, laying the chisel against the first cut as a guide, and so on. The first cut makes what is called a float, then commence again at the point, placing the chisel at the proper angle for the second cut, which is lighter than the first. The chisel is a straight thin edged one a little wider than the file, and short, say three inches long. Hold the file upon a lead lap with a strap, shank toward yourself, and hold the chisel between your thumb and fingers so that you can *see* the cut. 2. How to temper small drills, reamers, etc.; also springs made of high steel, old files for example? A. Harden small tools, such as drills, reamers, etc., at a low red heat in water and draw to a deep straw or yellow color. Old files are poor stuff to make springs of—you will only lose your time. It requires to be drawn very low, and will not yield high duty under any treatment. 3. A horizontal tubular boiler, which is used in the summer, but stands empty all winter, has some scale in it, mostly lime. Will freezing remove it? If not, what shall I use? Boiler is 36 inches by 12 feet. A. Freezing will not clean your boiler of lime scale. One or two quarts of tan liquor put into the boiler, or one pound of caustic soda or potash, and allowed to remain in for a day while the boiler is steamed up. Then blow out and clean out thoroughly. 4. In observatories, which is the standard timepiece—chronometer or clock? A. Chronometers and clocks are both used as standard timepieces for observation, according to convenience.

(12) C. F. M. says: I have a large lot of dark grease. It consists of about 65 per cent of tallow (beef) and 35 per cent of valvoline oil, which has been taken off from iron and wooden gears; after running some time has become black and dirty. Can you tell me how to cleanse it, and make it light in color? A. The bad color is, no doubt, chiefly due to carbon, formed by the heating of atoms of the grease during use. If so, the restoration of color will be a matter of much difficulty. Experiments might be made with solution of borax; also boiling and filtration.

(13) J. I. S. asks: 1. How many horse power will an engine of the following dimensions develop: Stroke, 4½ feet; diameter of cylinder, 15 inches, and making 38 revolutions per minute? A. Allowing 60 pounds average pressure on piston, 85 horse power. 2. How many revolutions will an engine 4 feet stroke, diameter of cylinder 15 inches, have to make in order to develop full as much power as first engine? Boiler pressure the same for both engines—say 80 pounds to square inch. Engines same construction, with heavy balance wheels and a variable load. A. Forty-three revolutions.

(14) O. M. W. asks: 1. What must be the steam pressure per square inch to make an engine—size of cylinder, 3 inches stroke by 1½ inches bore—develop one-quarter horse power? A. This will depend upon the speed of the engine. 2. What size of boiler should be used? The kind I propose is vertical, with one flue through the center. What size should the flue be? A. If for one-quarter horse power, should have 6 to 8 feet fire surface; we cannot give size of flue without knowing the design of boiler. 3. Will round steam ports do for the cylinder? Should they be made before boring the cylinder? Please state size, either round or square. A. Yes; but they will not be so good as the usual form. If round, should be one-half inch diameter. 6. How is an expansion ring made, used for packing the piston? A. By turning the ring a little larger than the bore of cylinder, cutting the ring at an angle, and cutting out a piece sufficient to permit the ring to be sprung into the cylinder. 5. What size steam pipe should be used to feed the engine, and how thick? A. Three-quarters of an inch diameter, and may be made of 24 or 30 ounce sheeting copper.

(15) F. B. R. asks: 1. What size of wire is required for line wire with the telephone described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 142? A. No. 12. 2. Should it be copper or iron? A. Iron will do. 3. What size of copper insulated (cotton covered) wire should be used for carrying around the house? A. No. 18 paraffine covered. 4. Could not the spool be wound with No. 34? A. 36 is better; 34 will do. 5. Would it make any difference if the spool was wound with 1 ounce instead of three-quarters per cent of No. 36; or would one-half per cent do? A. The spool should have 20 to 25 ohms resistance.

(16) F. E. B. asks: 1. If water is a conductor of electricity? A. Water is a poor conductor. 2. Also, give me the name of some substance that is a partial conductor, or a substance that is not a perfect insulator of electricity. A. Charcoal, gas carbon, metallic powder, mixed with powdered non-conductors, are all semi-conductors.

(17) W. R. B. asks for the process of manufacturing rouge of the lightest grade, for polishing telescopic objectives and other optical glass. Please give practical directions as minutely as your space will permit. Rouge of the requisite quality is difficult to find. Some is too soft to polish glass, others full of grit An occasional sample is found just right. In what part of the process does the variation come in making it "hard" or "soft" rouge? Does the quality of the sulphate of iron make any difference in the quality of the rouge? I wish to make my own. Have plenty of the best sulphate of iron. A. The process by which rouge is made in England is as follows: Good crystals of iron sulphate (carefully selected) are heated in a reverberatory furnace, the moisture and anhydrous sulphuric acid driven off, leaving the iron peroxide on the bed. The great difficulty in the process is to keep the temperature just right, and so prevent the agglomeration of the iron and its partial reduction to the proto state. It is in this latter point that the trouble occurs producing the grittiness. Imported French rouge, which is largely used by some glass houses, can be had of dealers in this city.

(18) M. K. asks: 1. How glycerine is dried. A. Glycerine cannot be dried, but can be agglutinated with gelatine. With litharge it forms glycerate of lead, which is quite solid. 2. How printing ink is made that will dissolve in water. A. We know of no printing ink soluble in water.

(19) J. D. R. asks: 1. Whether barium sulphate is at all soluble or not? I have an idea that there is some liquid which would dissolve it. A. Barium sulphate is slightly soluble in dilute acids; somewhat more so in strong sulphuric, nitric, and muriatic acids. According to Erdmann, barium sulphate is soluble in a saturated solution of ammonium nitrate. 2. Also, what was the last element discovered? A. Scandium, discovered by Nilson, and announced March 12, 1879, is the latest element concerning whose identity there is no doubt.

(20) A. A. H. writes: I wish to erect machinery for crushing and pressing the oil out of cotton seed, and am unable to get the necessary information on the subject, and in my emergency apply to you. I wish to know about the cost of the machinery, to whom to apply to get it, and, if you are familiar with the subject, how much oil will a bushel of seed yield, and if the oil has to be refined the cost and process of refining? A. For full particulars as to cost, processes, etc., see SUPPLEMENT, No. 329, "Manufacture of Cotton Seed Oil."

(21) W. N. G. writes: Some time ago I attempted to make some indelible ink for rubber stamps. The recipe was as follows: Nit. sil., ½ ounce; Liq. ammon., 1¼ ounce; sal soda, ¾ ounce; gum arabic, ¾ ounce; and 1 ounce rain water. Color with lamp black, and thicken with sugar. Now, I made it according to directions, but it would wash out. I put the stuff in an open bowl and let all the liquid evaporate. How can I fix it now to use it and have a good ink? What can I use in the place of glycerine, or use with it in making ink for stamps? A. Dissolve it in a few drops of nitric acid, and add the water and ammonia as called for in the receipt. It will not wash out if properly applied by heat or the action of sunlight. If necessary, a weak solution of oil of cloves in alcohol may be used as a mordant.

(22) D. S. writes: 1. I have a boiler 26 inches in diameter and 36 inches high, with fifty-two 1¾ inch flues; firebox, 22 inches diameter and 13 inches high. Will it run a 4 inch by 4½ inch engine? A. Yes. 2. How large a propeller wheel will the engine run by being connected to the wheel shaft without any gears; I mean by that, to have the engine shaft and the propeller shaft connected straight through? A. 20 inches to 24 inches diameter. 3. How fast will it run a boat 23 feet long and 5 feet beam? A. About 8 or 8½ miles per hour, if a good model. 5. How many revolutions will the engine make per minute to do this? A. 240 to 280, according to pitch of screw.

(23) C. E. G. asks how to mix black and white water color paint for showcard painting. Have been using lamp black, glue water, and varnish, but I can't get the high shine on letters when finished. A. Use a solution of shellac in a strong solution of borax and water instead of the glue water.

(24) H. K. asks: Could I pump water from my spring by having the pump 200 feet away and 10 feet higher than the spring, the water passing through 2 inch pipe? A. Yes.

(25) Q. E. D. asks: 1. What solvent should I use for the purpose of dissolving scrap rubber, such as old overshoes, for the purpose of making a paste so as to mould it into any desired shape, and for it to then become hard and solid, and resist acids? A. The best solvent for rubber is a mixture of methylated ether and petroleum spirit—the common benzolene used in sponge lamps. The general method, however, of utilizing old India-rubber is by heating it with steam; the sulphur then discharges, the India-rubber melts, runs into the hot water, and collects at the bottom of the pit, while the vapor prevents its burning. 2. Also, how should I treat gutta-percha for the same purpose? A. Crude gutta-percha is soluble in carbon disulphide, and is redeposited in a pure condition after the evaporation of the solvent. Also, benzine, chloroform, and oil of turpentine dissolve it easily with the aid of heat.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

A. G.—Both Nos. 1 and 2 are specimens of garnet, possessing no value, except as mineralogical specimens. —W. W. G.—It is a very fine grained siliceous sinter, of great value for polishing; worth from 2 to 5 cents per pound in New York city. We seldom see such an excellent material.—F. A. B.—Iron pyrites of little or no value, except by the ton for the manufacture of sulphur.—J. W. F.—Common mica, of no value.—J. P.—It is a mixture of quartz, magnetite, garnet rock, menacranite, and dirt, of no value either as sand or ore.—L. S. K.—Your ore holds a small percentage of sulphuret of silver. An assay would be advisable. $5.—J. H.—It is a compound of oxides of iron, magnesia, manganese, alumina, and silica, of no metallurgical value.—A. S.—The ore contains a large percentage of tin, as oxide. An assay would be advisable.—J. N. D.—It is mainly of sulphate of lime. If it cakes in the boiler and firmly adheres to the iron, it is most decidedly injurious. For safety, we would advise you to use some boiler incrustation preventive.—A. H. J.—No. 1. Spathic iron ore, with hematite crystals of the first. 2. *a.* The body of the ore is red oxide of copper; *b.* the green—green silicate of copper—chrysocolla. 3. *a.* Siderite, carbonate of iron; *b.* spathic iron, similar to *a*, but crystallized; *c.* quartz crystals—silica. 4. Spathic iron, similar to 3, *b*. 5. The green portion is hornblende. 6. The black is tourmaline, on calc spar (pink). 6. Pink calc spar—carbonate of lime. 8. Tourmaline. 9. Limonite—hydrated oxide of iron; a very valuable ore. An analysis will be necessary to determine this for No. 1 and this. 10. Calamine—silicate of zinc. 11. Magnetite, holding crystals of actinolite; the first is a valuable ore, and worthy of an analysis.

COMMUNICATIONS RECEIVED.

On Freezing of Water. By F. J. C.
A Meteor. By J C. H.
On Comets. By B. S. B.
On the Potato. By J. D. C.
A New Theory of Tides. By J. W. N.
On Leap Years. By O. C.
Electricity and its Theories of To-day. By A. S. R.

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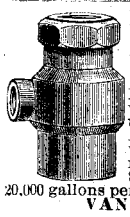
WANTED.
A competent **Engineer** to run the engines for an Otis Elevator in a dry goods house. Address, with references as to capacity and character, P. O. Box 2, New York.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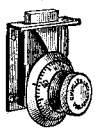
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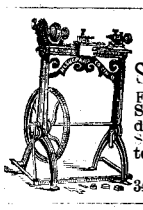
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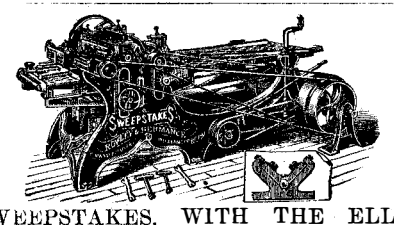
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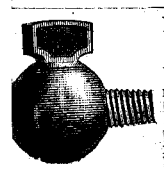
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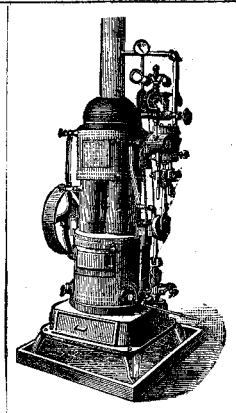
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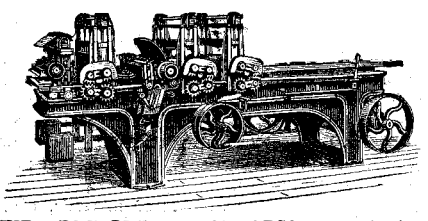
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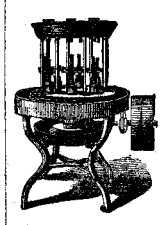
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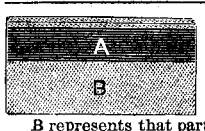

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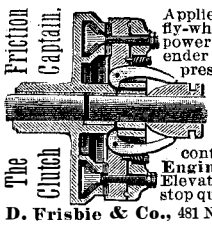

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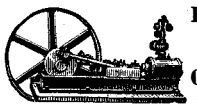
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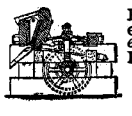
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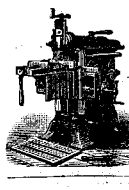
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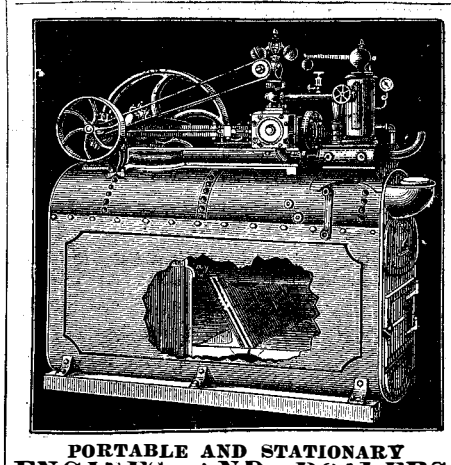
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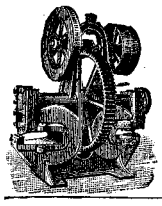
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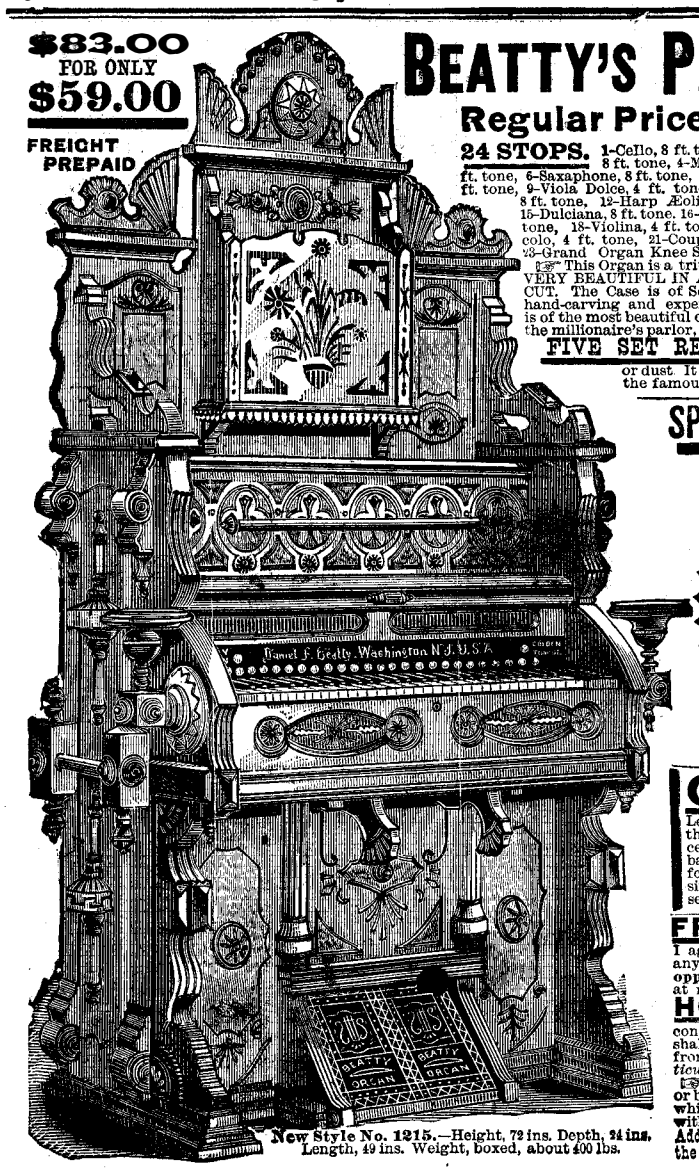

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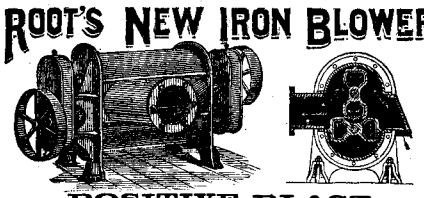

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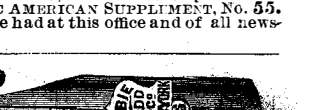

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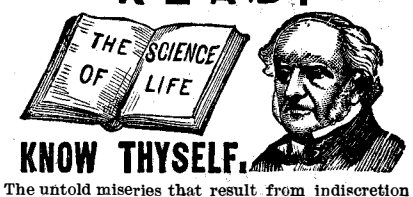

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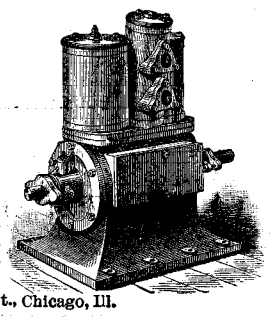

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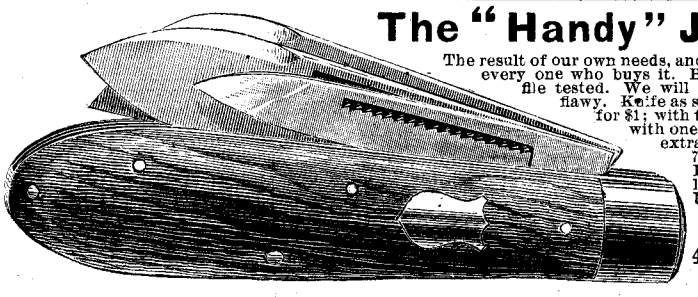

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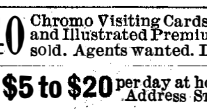

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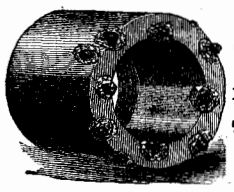

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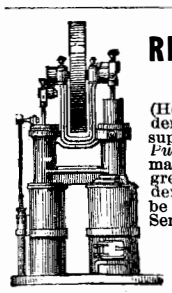

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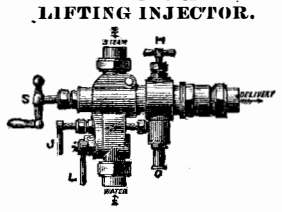

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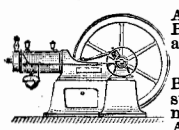

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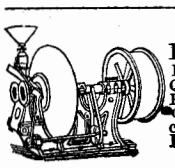

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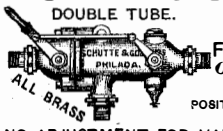

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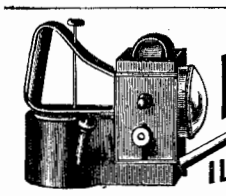

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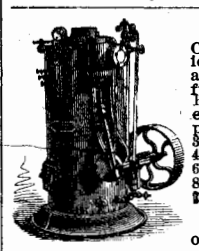

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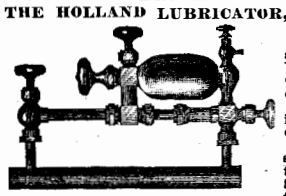

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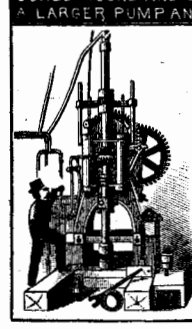

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